

Keys to the genera and species of blow flies (Diptera: Calliphoridae) of the West Indies and description of a new species of *Lucilia* Robineau-Desvoidy

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Abstract

Keys to 11 genera and 21 species of Calliphoridae found or likely to be found in the West Indies are given. Species distributions and key characters are discussed. *Lucilia fayeae* **sp. nov.** is described from numerous specimens from Dominica, Puerto Rico, St. Lucia, and St. Vincent. *Calliphora maestrica* Peris *et al.* is redescribed and the male of the species is described for the first time.

Key words: Diptera, Calliphoridae, *Lucilia*, new species, West Indies, blow flies

Introduction

The blow flies of the West Indies have rarely been studied and are poorly known. Persons wishing to identify Calliphoridae from this area must use keys from North or South America. This has proven confusing because these keys include many species not occurring in the West Indies and lack several species unique to the area. The fauna of Calliphoridae in the West Indies is a mixture of Central American, South American, North American, and Old World species, along with at least seven endemic species. One of the first efforts to identify species of blow flies in the West Indies was by Shannon (1926) who provided a synopsis of all known blow fly species from the Americas. He described two new species from the area, *Cochliomyia minima* Shannon and *Lucilia rica* Shannon, and discussed which valid species occurred in the region. Aubertin (1933) included several species of *Lucilia* Robineau-Desvoidy from this area in her revision of the genus. She noted that *Lucilia* from the region have few distinctive characters and was unsure about which valid species were present. Hall's (1948) keys included several species that occur in the West Indies, including four species of *Cochliomyia* Townsend (under *Callitroga* Brauer) and four species of *Lucilia* (under *Phaenicia* Robineau-Desvoidy), including two species of the latter unique to the area; i.e., *L. problematica* Johnson and *L. rica* Shannon. James (1967) published a brief note on blow flies from Dominica including *Cochliomyia macellaria* (Fabricius) and what he described as non-typical *L. eximia* (Wiedemann). James (1970), in his "Catalog of the Diptera of the Americas south of the United States," listed many of the species known from this area at the time and provided distribution data and synonymies. James (1971) described two new species of *Lucilia* (under *Phaenicia*), *L. lucigerens* (James) from Jamaica and *L. retroversa* (James) from Bahamas and Cuba. Dear (1985) performed a detailed study of the Chrysomyinae of the Neotropical Region, including several species found in the West Indies. His work included synonymies and keys to genera and species. Downes (1986) listed three species of Melanomyinae from this area and provided genus and species keys. Woodley and Hilburn (1994) collected blow flies in Bermuda and reviewed species recorded from that area. The authors were unable to collect any *L. problematica* from the island and speculated this species may be extinct. They also noted that *L. rica* was the dominant *Lucilia* from Bermuda; this was the first record of it from the island. Peris *et al.* (1998) described a new species of *Calliphora* from Cuba, *C. maestrica* Peris *et al.*, based on female specimens only. Vargus and Wood (2010) keyed and discussed the genera of Central American blow flies, and their key was helpful in the preparation of the genus keys herein.

This study of blow flies in the West Indies was initiated to address the following issues: to establish what valid species occur in the region; to provide keys to permit species identification; to redescribe five little known species of *Lucilia*; to describe one new species (*Lucilia fayeae*); and to redescribe *Calliphora maestrica*, including genitalia of both sexes.

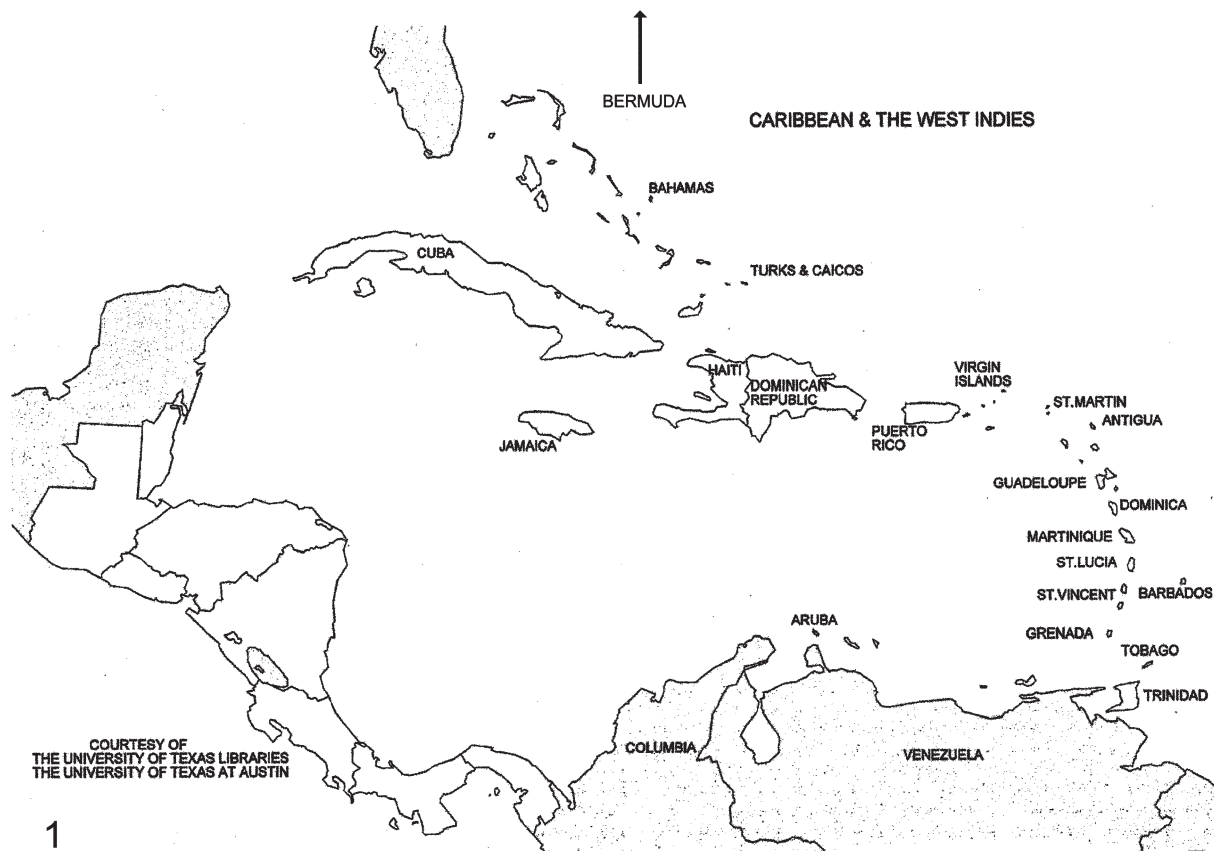


FIGURE 1. Map of the West Indies.

Material and methods

Geography. The term West Indies is used to include the islands from Trinidad and Tobago off of the coast of Venezuela north to Dominica and Antigua, west to Cuba and Bahamas, including the Greater and Lesser Antilles. Bermuda is included with these islands because of a shared fauna, though it is isolated and far northeast of Bahamas (Fig.1).

Terminology. The terminology and taxonomy follow Whitworth (2006) and is largely in agreement with McAlpine (1981); see discussion of exceptions in Whitworth (2006). Figures 1–10 in that publication should be consulted for an overview of characters used herein. Generally, proportional measurements of the head were made with the aid of an ocular micrometer at 42x. The statement, “head: frons ratio 0.12 (0.11–0.13/15)” means that the ratio ranged from 0.11–0.13 and averaged 0.12 for 15 specimens. Frons width was measured at the narrowest point while parafacial width was measured at the widest point. For more information on proportional measurements, refer to Sabrosky *et al.* (1989: 57).

There are several key characters that can be difficult to interpret. The area between the posterior margin of the eye and the postocular setae is referred to here as the postocular area. The color of the postocular area, fronto-orbital plate and parafacial are used in the keys, and should be assessed when viewed from directly above. Another character used primarily for *Lucilia* is the pattern of microtomentum on the dorsum of the thorax and abdomen. This character is subtle but consistent when viewed at a sharp angle from the posterior.

Abbreviations. Terms used for tibial setae are t1, fore tibia, t2, mid tibia, t3 hind tibia; for setal orientation, a = anterior, ad = anterodorsal, av = anteroventral, d = dorsal, p = posterior, pd = posterodorsal, pv = posteroventral, and v = ventral (see Whitworth 2006, fig. 83). For abdominal sclerites, tergites are identified as T and sternites as ST. T1+2 is the first apparent abdominal tergite, followed by T3–8, sternites are ST1–8.

The following acronyms are used for lending institutions:

BMNH	Natural History Museum, London, United Kingdom
CAS	California Academy of Sciences, San Francisco, California, USA
CMNH	Carnegie Museum of Natural History, Pittsburgh, Pennsylvania, USA
CNC	Canadian National Collection of Insects, Ottawa, Ontario, Canada
FSCA	Florida State Collection of Arthropods, Gainesville, Florida, USA
JC	Jonathan Cammack, private collection, Raleigh, North Carolina, USA
KR	Knut Rognes, private collection, Stavanger, Norway
LSAM	Louisiana State Arthropod Museum, Louisiana State University, Baton Rouge, Louisiana
MCZ	Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts
TW	Terry Whitworth collection, Puyallup, Washington, USA
UCDC	R.M. Bohart Museum of Entomology, University of California, Davis, California, USA
UGG	University of Guelph, Guelph, Ontario, Canada
UPR	University of Puerto Rico, Mayaguez, Puerto Rico
USNM	National Museum of Natural History, Smithsonian Institution, Washington, District of Columbia, USA
USU	Utah State University, Logan, Utah, USA
WSUP	M.T. James Entomological Collection, Washington State University, Pullman, Washington, USA

Illustrations. Features unique to species in the present paper are fully illustrated. For an overview of other features, see figures in Whitworth (2006).

Synonymies. Older synonymies detailed by previous authors (Hall 1948; James 1970; Dear 1985; Rognes 1991) have not been repeated. Numerous articles on Neotropical *Lucilia* have been published using the synonym *Phaenicia*.

Dissections. The procedure for extending the male genitalia into view was described by Whitworth (2006). For more detailed information on the dissection and examination of both male and female genitalia, refer to Rognes (2009). Briefly, dissection involves removing all or part of the abdomen and heating it in 10% potassium hydroxide solution in a bath of boiling water for about two minutes. The abdomen is then transferred to fresh water to rinse and to 95% ethanol for a few minutes to fix the integument. Finally it is transferred to glycerine for dissection. Drawings of male genitalia were usually made from specimens in glycerine. Male genitalia and abdominal sternites were usually transferred to microvials with glycerine and pinned below their respective specimens; tergites were ultimately dried and glued to a small square of label paper pinned below the specimen. Ovipositors and associated parts were generally mounted on a slide with Euparal.

Dissections were performed primarily with a Meiji Techno stereomicroscope with a focus range of 7.5–112.5x using 1.0x and 1.5x objectives. Images were taken through the microscope with a Nikon D90 camera or a Zarbeco 3.1 megapixel camera. Slides and small specimens were studied with the aid of a CHT model Olympus compound microscope with 40–400x lenses. Adult specimens were studied with a Bausch and Lomb Stereozoom 7(10–70x) equipped with fiberoptic lights.

Condition of specimens. Much of the material examined was 50 years old or older and often in poor condition. Most of the more recent material had been collected in alcohol which distorts characters and discolors specimens making identification difficult. To further complicate identification, even freshly killed specimens often appeared teneral and would distort and discolor as they dried. This condition has been observed in many tropical blow flies, especially in the genus *Lucilia*.

Collection areas and collection techniques. The islands of Puerto Rico, Dominica and Antigua were visited in the spring of 2009 to collect specimens for this study. Most blow flies were collected with a

modified butterfly trap (BioQuip®) and baited with carrion. Fish was readily available, durable and was usually the preferred bait. The fabric of the upper portion of the trap was sprayed with a residual insecticide containing permethrin to kill trapped flies quickly. Failure to do this resulted in many damaged specimens. Traps were usually emptied daily and specimens pinned immediately, if possible. Some live flies were captured and killed in 95% ethyl alcohol for future use in a molecular analysis.

Species identifications. Identified specimens were examined from USNM and WSUP, including types of *Lucilia rica* (USNM) and paratypes of *Lucilia lucigerens* and *L. retroversa* (WSUP). Specimens from the West Indies were sorted to genus, and then identified to species based on the available literature. The keys to the genera and species found or likely to be found in the West Indies were based on these identified specimen.

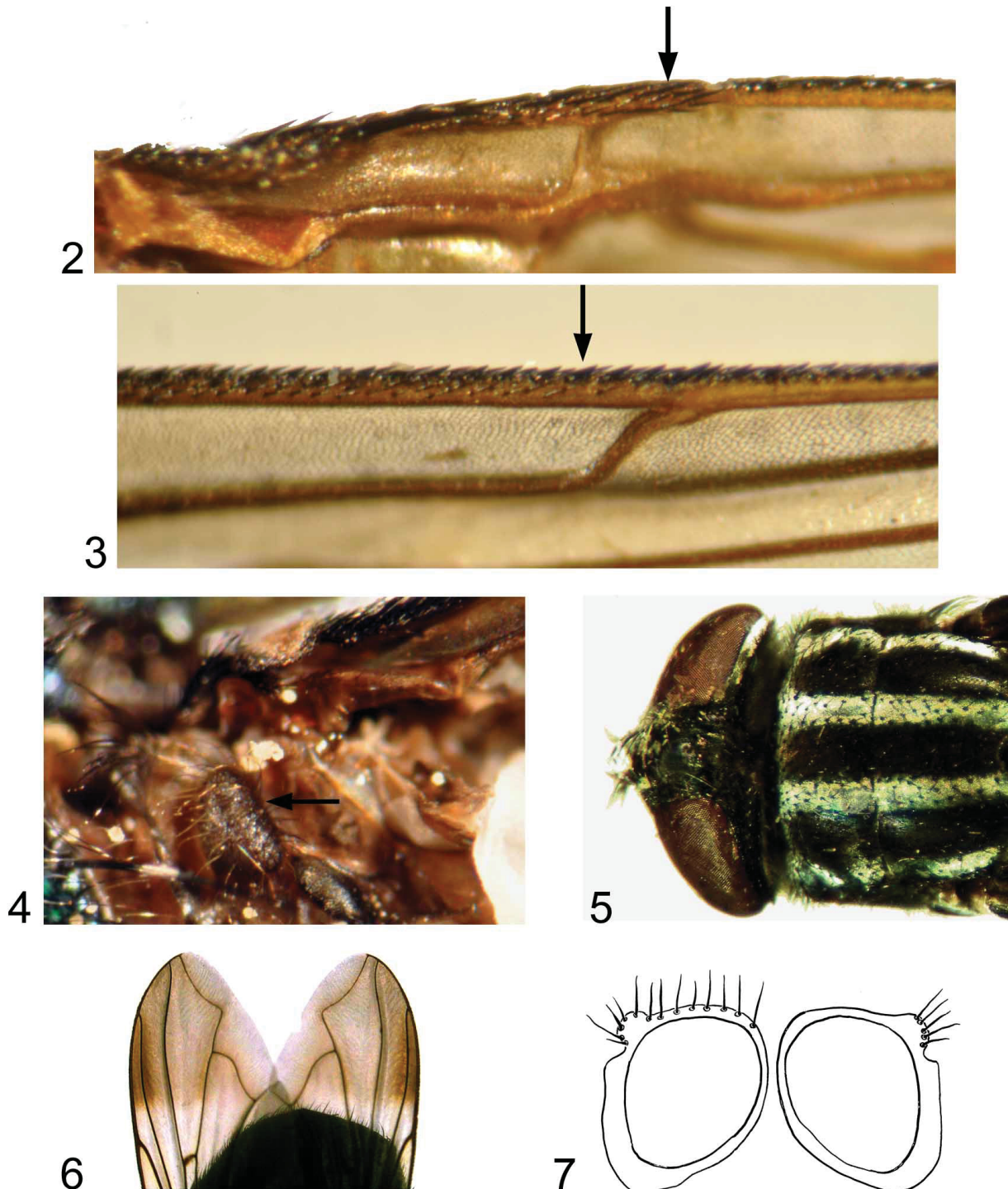
Key to the subfamilies and genera of blow flies in the West Indies

1. Basal section of stem vein setose dorsally (Whitworth 2006, fig. 6); greater ampulla reniform shape; subcostal sclerite with distinct setulae (except *Stomorphina*) 2
- Basal section of stem vein bare above (Whitworth 2006, fig. 14); greater ampulla oval in shape; subcostal sclerite bare or with pubescence 7
2. Venter of costa with setae to just beyond humeral crossvein (Fig. 2); subcostal sclerite bare; arista bare on lower side; gena with dense long white setae; face below vibrissae protruding; Bermuda only in the Americas. Rhiniinae, *Stomorphina lunata*
- Venter of costa with setae to junction with subcosta (Fig. 3); subcostal sclerite with at least a few dark setae; arista with distinct setae on the lower side; gena usually with darker setae; face not protruding below vibrissae Chrysomyinae...3
3. Greater ampulla with stiff erect setae (Fig. 4); lower calypter covered with dense setae, dorsum of abdominal T1+2 black, posterior margins of T3 and 4 black *Chrysomya*
- Greater ampulla bare or with short, fine setulae; lower calypter bare or with only a few pale setae. Abdomen color pattern not as above 4
4. Genal dilation yellow or orange, with mostly yellow setae; head with predominantly yellow vestiture; posterior margin of hind coxa setose; anterior thoracic spiracle with pale lappets 5
- Genal dilation usually dark, with dark setae; head with dark vestiture; posterior margin of hind coxa bare or with weak setae; anterior thoracic spiracle with orange lappets *Phormia regina*
5. Apex of wing transparent; mesonotum, especially prescutum and scutum with three polished black vittae alternating with gray, blue, or green microtomentose vittae (Fig. 5); palp filiform (Whitworth 2006, fig. 20) *Cochliomyia*
- Apex of wing beyond r-m crossvein tinted brown (Fig. 6, best seen with the unaided eye); mesonotum without distinct vittae; palp clavate (as in Whitworth 2006, fig. 3) 6
6. Posterior margin of hind coxa setose only on the posterolateral corner (Fig. 7); male eye with upper facets enlarged and sharply delineated (as in Fig. 19); ventral surface of costa setulose to junction with R1 *Chloroprocta*
- Posterior margin of hind coxa setose on entire width (Fig. 7); upper facets of male eye not significantly enlarged; ventral surface of costa setulose just to the junction of the subcosta; known only from Trinidad in the West Indies ... *Hemilucilia*
7. Middle of proepisternal depression bare; dull body color, subshining, not metallic 8
- Middle of proepisternal depression setose (Whitworth 2006, fig. 15); usually shining metallic green, blue or bronze, sometimes dulled by microtomentum 11
8. Thorax with yellow crinkly setae; gena usually half height of eye (Whitworth 2006, fig. 25); coxopleural streak present (as in Whitworth 2006, fig. 16); parafacial setose to lower eye margin Polleniinae, *Pollenia*
- Thorax without yellow crinkly setae; gena about one-fourth eye height (Whitworth 2006, fig. 27); coxopleural streak absent; parafacial bare on lower half or more Melanomyinae...9
9. Posterior surface of head with some whitish setae (may be sparse, some behind mouthparts) 10
- Posterior surface of head with dark setae only, not currently known from the West Indies *Angioneura* and *Opsodexia* (see Downes 1986 for key to species)
10. Dorsal surface of scutellum with few or no setae *Glutoxys elegans*
- Dorsal surface of scutellum setose *Pseudopsodexia*
11. Dorsal surface of lower calypter setose (Whitworth 2006, fig. 31); thorax dull gray, abdomen subshining blue; suprasquamal ridge bare or with inconspicuous fine setae Calliphorinae, *Calliphora*.
- Dorsal surface of lower calypter bare (Whitworth 2006, fig. 14); thorax usually shining green, blue or bronze (except *Lucilia problematica*); suprasquamal ridge posteriorly with a distinct sclerite with a conspicuous cluster of setae near base of scutellum (Whitworth 2006, fig. 14) Luciliinae, *Lucilia*

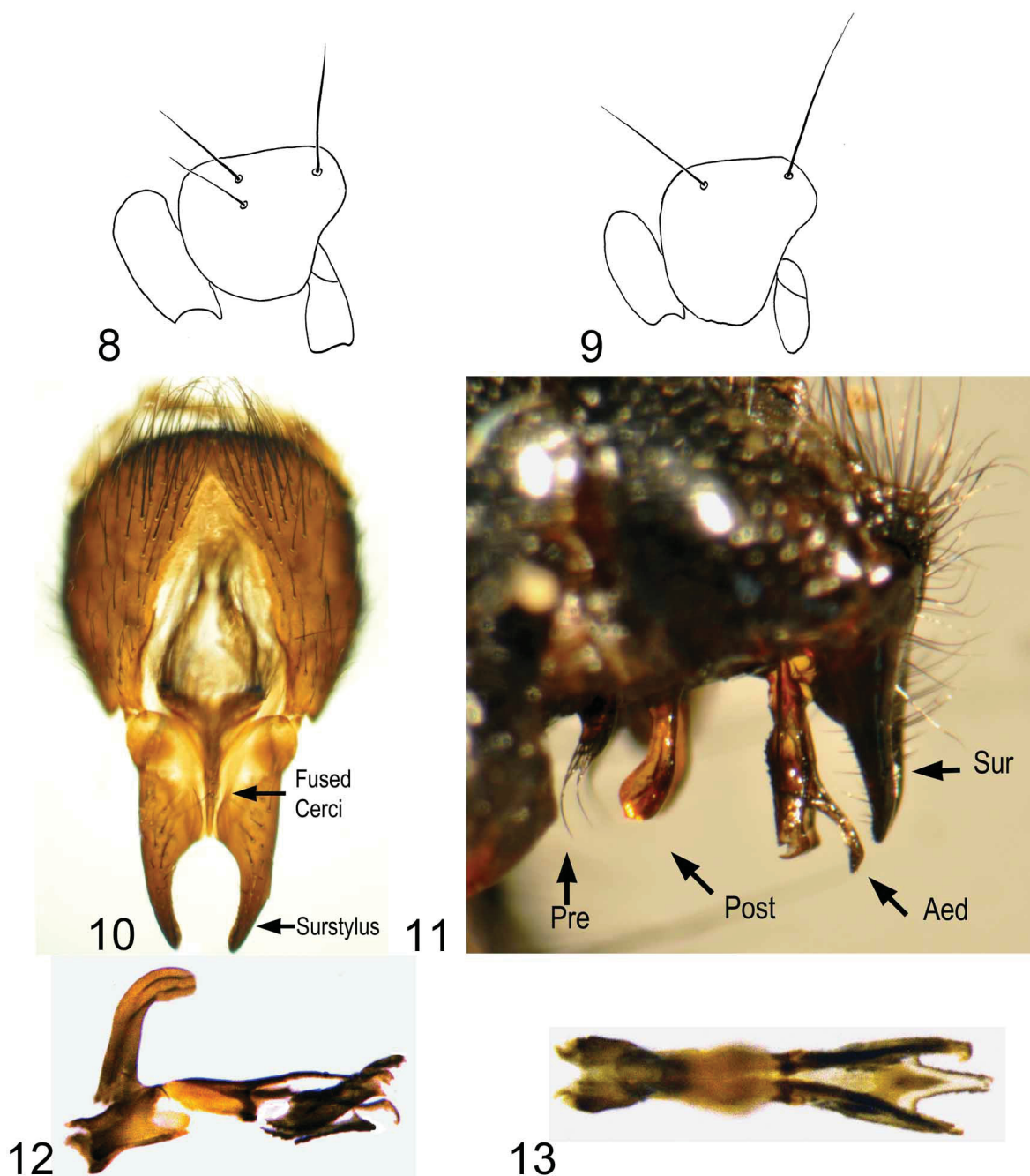
Subfamily Calliphorinae

Genus *Calliphora* Robineau-Desvoidy

This is the only genus of this subfamily in the West Indies. It can be recognized by its bare stem vein above, lower calypter setose above, setose proepisternal depression, dull, microtomentose thorax and more or less



FIGURES 2–7. 2. *Stomorphina lunata*, venter of costa with setulae to just past humeral crossvein. 3. *Cochliomyia macellaria*, venter of costa with setulae to junction with subcosta. 4. *Chrysomya rufifacies*, greater ampulla with stiff, erect setae. 5. *Cochliomyia macellaria*, vittae on thorax. 6. *Hemilucilia* spp., apex of wing beyond r-m crossvein tinted brown. 7. Left figure, *Hemilucilia* spp., posterior margin of hind coxa with setae along entire width. Right figure, *Chloroprocta idioidea*, posterior margin of hind coxa with setae only on posterolateral corner.



FIGURES 8–13. 8. *Calliphora vicina*, katepisternal formula 2:1. 9–13. *Calliphora maestrica*. 9. katepisternal formula 1:1. 10. Posterior view of male genitalia. 11. Left lateral view of genitalia; abbreviations, Phal = phallus, Post = postgonite, Pre = pregonite, Sur = surstylus. 12. Left lateral view of phallus. 13. Dorsal view of phallus.

shining blue abdomen. Only one species, *C. maestrica* Peris *et al.*, has been found in the West Indies, but *C. vicina* Robineau-Desvoidy has been included here since it occurs in nearby Central America and shares a yellow basicosta.

Key to the species of *Calliphora* of the West Indies

1. Basicosta yellow to orange 2
- Basicosta dark brown to black mainland *Calliphora* species, not keyed further.

2. Genal dilation with reddish ground color on anterior half or more; katepisternal formula 2:1 (Fig. 8); male frons narrow, 0.075 head width; not collected in the West Indies to date.....*C. vicina*
- Genal dilation wholly dark; katepisternal formula 1:1 (Fig. 9), male frons broad, 0.29 (0.28–0.30/5) head width, slightly narrower than width of eye; known only from Cuba, Jamaica and the Dominican Republic*C. maestrica*

***Calliphora maestrica* Peris, Gonzalez-Mora, Fernandez, and Peris**

Figs. 9–18

Calliphora maestrica Peris, Gonzalez-Mora, Fernandez, and Peris, 1998: 49.

This species was originally described from the Sierra Maestra region, Cuba based on four female specimens. Five males and ten females were examined to characterize this species. The authors described the unusual condition in this species of only two katepisternal setae (see Fig. 9) and noted it has an orange basicosta which is found in only one other New World *Calliphora*, *C. vicina*. The genitalia in both sexes are highly modified and unlike any *Calliphora* in the Nearctic or mainland Neotropical Region.

Diagnosis. Basicosta orange, a character shared only by *C. vicina* in the New World; two, rather than three katepisternal setae which is the condition found in all other known New World *Calliphora*; male frons exceptionally broad, 0.29 of head width, nearly as broad as female frons (0.33 of head width); male surstyli forceps-like, cerci fused and withdrawn into base of surstyli; ovipositor unlike other *Calliphora* in the Neotropical Region.

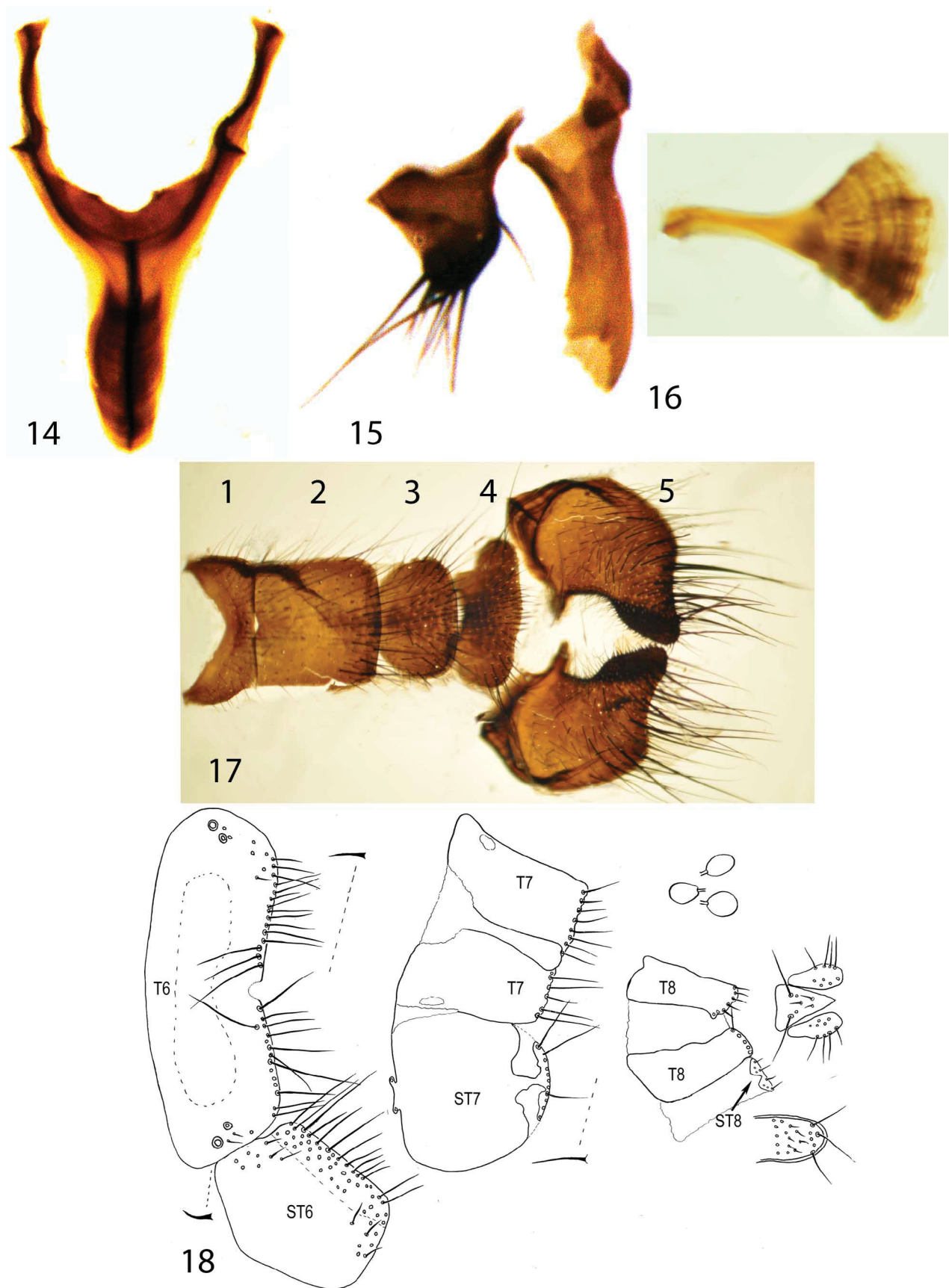
Measurements. Male frons exceptionally broad, 0.29 (0.028–0.30/5) of head width, only slightly narrower than female frons width, which is 0.33 (0.32–0.33/5) of head width.

Male genitalia. Surstyli forceps-like, cerci fused and withdrawn between bases of surstyli (Fig. 10). When surstyli are pulled down, posterior end of phallus and pre- and postgonites are exposed (Fig. 11). Phallus (Figs. 12–13) with epiphallus strong and curved down, at base joining distal part of basiphallus. Paraphallus ends in a hook curved sharply downward and acrophallus long and slender; it is unclear if there are lateral ducts, although pale curved channels in Fig. 13 may represent them. Hypandrium as in Fig. 14. Pregonite has a dense row of about 10 setae; postgonite robust and has a single tiny seta (Fig. 15). Ejaculatory sclerite large and fan-shaped (Fig. 16). ST 5 of the male very broad (Fig. 17).

Female genitalia. T6 very short and broad for *Calliphora* with a wide, weakly sclerotized area in middle, and an inverted v-shaped notch posteriorly (Fig. 18). Posterior margin of the sclerite has a row of strong setae which extends up the edge to the paired spiracles; there are no microtrichia on this segment. ST6 broad, with wide rows of setae posteriorly and laterally; with microtrichia on the posterior quarter of segment. T7 divided medially by a Y-shaped area of weak sclerotization; posterior edge of each half has inward extensions. ST7 large and somewhat oval with hind portion almost isolated by a membranous area, posterior edge has a strong row of setae. T8 halves widely separated; ST8 reduced to two small triangular sclerites with setae posteriorly.

Material examined. Dominican Republic (5 males, 8 females, CMNH): 1 male, 2 females, Independencia, Sierra de Baboruco, Lama del Toro. 5.3 km sw El Aquacate, 29–30 March, 2004, C. Young, R. Davidson, J. Rawlins, pine forest; yellow pan trap 2316 m; 3 males, same area as above, 7–8 Nov., 2002, W.A. Zanol, C.W. Young, C. Starensic, J. Rawlins, hand collected in meadow in pine woods; 1 male, 1 female, San Juan, Sierra de Neiba, 9.4 km ssw, El Cercado, 18–19 Nov., 2004, C. Young, J. Rawlins, C. Nunez, V. Verdecia, meadow in mature pine forest, yellow pan trap, 1973m; 3 females, Vega Cordillera Central Reserve, Balle Neuvo La Nevera, 15.1 km se Valle Nuevo, 25 May, 2003, R. Davidson, C. Young, C. Nunez, P. Acevedo, in cloud pine forest, hand collected, 2252m; 1 female, same as previous site except 5.2 km ESE Valle Nuevo, 23 May, 2003, 2288m; 1 female, RD–255, La Comparticion, Pico Duarte, PN Armando Bermudez, La Vega Province, July 1, 2004, D. Perez, 2,450–3087m. **Jamaica** (BMNH): 1 female, Jan., 1930, no exact location or collector. **Cuba** (USNM): 1 female, Cumbre-Pico Turquino, July 22, 1922, S.C. Bruner and C.H. Ballou.

Distribution. Specimens were examined from Cuba, Dominican Republic, Jamaica.



FIGURES 14–18. *Calliphora maestrica*. 14. Hypandrium. 15. Pre- and postgonites. The postgonite possesses a small basal pore with a very fine seta that is not visible in the image. 16. Ejaculatory sclerite. 17. Male abdominal sternites. 18. Female ovipositor and spermathecae.

***Calliphora vicina* Robineau-Desvoidy**

Fig. 8

Calliphora vicina Robineau-Desvoidy, 1830: 435

Calliphora vicina: Hall, 1948: 307

Diagnosis. This species has a yellow basicosta, a genal dilation with reddish ground color on anterior half or more; katapisternal setal formula of 2:1 (Fig. 8) and male frons 0.075–0.12 of head width.

Distribution. *Calliphora vicina* is widespread and common in North America and has been found south to Mexico City and Panama, though it is not recorded from the West Indies. It is also found in southern South America and throughout the Palearctic and Oriental Regions.

Subfamily Chrysomyinae

Members of this subfamily are recognized by a dorsally setose stem vein and setose subcostal sclerite. There are five genera in the West Indies.

Genus *Chloroprocta* Wulp

This genus has a single species.

***Chloroprocta idioidea* (Robineau-Desvoidy)**

Figs. 6, 7, 19

Chrysomya idioidea Robineau-Desvoidy, 1830: 435

Chloroprocta idioidea: Dear, 1985: 113

Diagnosis. Apex of wing beyond r-m crossvein tinted brown (as in Fig. 6); posterior margin of hind coxa with a few setae on the posterolateral corner (Fig. 7); male eye facets enlarged (as in Fig. 19); ventral surface of costa setulose to junction of R1.

Distribution. Specimens were examined from Bahamas, Cuba and Trinidad (USNM) and Dominican Republic (CNMH). Dear (1985) listed it from Bahamas, Cuba and Trinidad.

Discussion. Shannon (1926) and Hall (1948) believed there are two species of this genus in the region. Dear (1985) concluded there is only one and authors claiming there are two species were relying on variable characters as part of intraspecific variation.

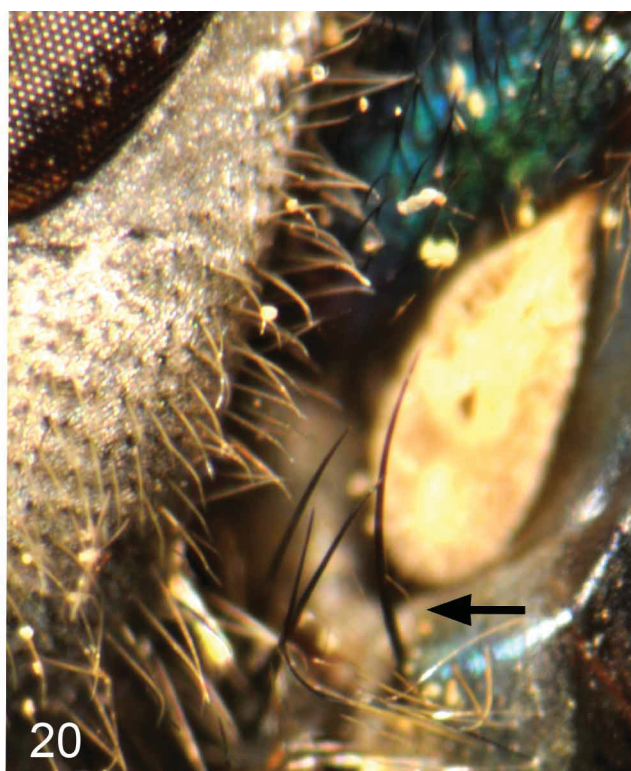
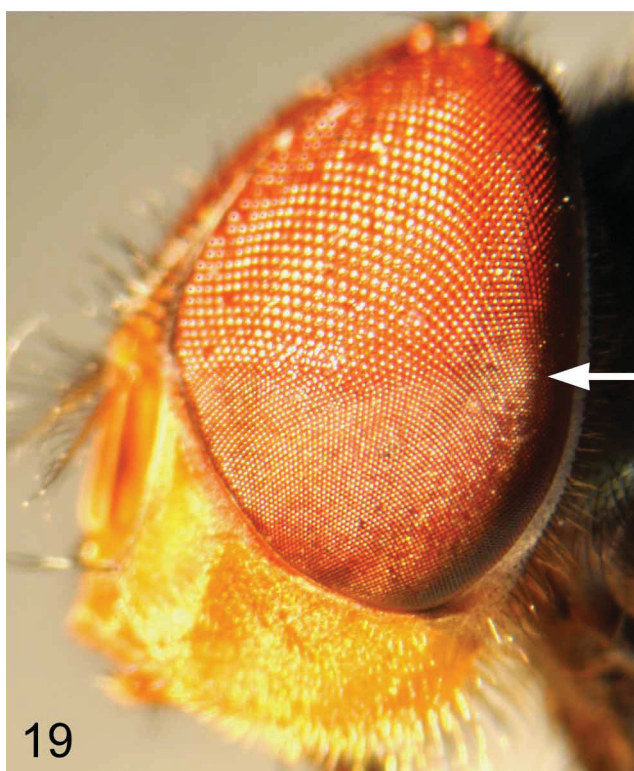
Genus *Chrysomya* Robineau-Desvoidy

Diagnosis. Greater ampulla setose (Fig. 4); T1+2 wholly black, T3 and T4 with only posterior margins black (Whitworth 2006: fig. 18).

Discussion. Four species of this genus have been introduced into the Neotropical Region from the Old World. Only three species occur in the West Indies: *C. albiceps* (Wiedemann, 1819), *C. megacephala* (Fabricius, 1794), and *C. rufifacies* (Macquart, 1844). The fourth species, *Chrysomya putoria* (Wiedemann, 1830), is not known from the West Indies.

Key to the species of *Chrysomya* in the West Indies

1. Lappets of anterior thoracic spiracle brown to dark brown; genal dilation with orange vestiture and setae; male eye with upper facets much enlarged and with sharp demarcation from small facets below (Fig. 19)..... *C. megacephala*
- Lappets of anterior thoracic spiracle pale; genal dilation with pale vestiture and white setae; eye facets of male with no clear line of demarcation between larger and smaller facets 2
2. Proepisternal seta absent..... *C. albiceps*
- Strong proepisternal seta present (Fig. 20) 3
3. Notum mostly shining, little or no tomentum when viewed from rear; male frons width twice the width of anterior ocellus; male outer vertical seta usually present; female with posterior margin of T5 with cleft (Whitworth 2006, as in fig. 49)..... *C. rufifacies*
- Notum with more whitish tomentum, especially along edge of mesonotum; male frons width less than the width of anterior ocellus; male outer vertical seta usually absent; female with rear edge of T5 without a cleft; not currently known in West Indies, but found in South and Central America..... *C. putoria*



FIGURES 19–20. 19. *Chrysomya megacephala*, male eye with upper facets enlarged and sharp demarcation between upper and lower facets. 20. *Chrysomya rufifacies*, proepisternal seta present (anterior spiracle in background).

Chrysomya albiceps (Wiedemann)

Musca albiceps Wiedemann, 1819: 38

Chrysomya albiceps: Dear, 1985: 113

Diagnosis. This species is similar to *C. putoria* and *C. rufifacies*, but lacks a proepisternal seta.

Distribution. This species was found near Calibishe, Dominica (TW); Dear (1985) listed it from Puerto Rico.

Discussion. Wells and Sperling (1999) debated if *Chrysomya albiceps* and *C. rufifacies* are each a valid species since they appear very similar. They concluded they are recently evolved separate species.

***Chrysomya megacephala* (Fabricius)**

Fig. 19

Musca megacephala Fabricius, 1794: 317

Chrysomya megacephala: Dear, 1985: 112

Diagnosis. Lappets of anterior thoracic spiracle brown; genal dilation with orange vestiture and setae; male with upper eye facets much enlarged (Fig. 19).

Distribution. Examined specimens were from Dominica (TW), Dominican Republic (CMNH), Jamaica (USNM), and Puerto Rico (TW, UPR). Dear (1985) listed it from Puerto Rico.

***Chrysomya putoria* (Wiedemann)**

Musca putoria Wiedemann, 1830: 403

Chrysomya putoria: Dear, 1985: 112

Diagnosis. Notum with whitish tomentum on thorax, especially along edge of mesonotum; male frons width less than the width of anterior ocellus; male outer vertical seta usually absent; female posterior margin of T5 without a cleft.

Distribution. This species is not known from the West Indies, but is found throughout South America.

Discussion. There has been confusion about the species name. Zumpt (1956) considered it a synonym of *C. chloropyga* (Wiedemann, 1818). Later he listed it as a valid species (Zumpt 1965), but confusion continued. Rognes and Paterson (2005) studied both nominal species and concluded both are valid, with *C. putoria* being found in Brazil, Colombia, Panama and Peru while *C. chloropyga* is restricted to the Afrotropical Region. I have subsequently identified *C. putoria* from Bolivia as well.

***Chrysomya rufifacies* (Macquart)**

Lucilia rufifacies Macquart, 1844: 303

Chrysomya rufifacies: Dear, 1985: 113

Diagnosis. Notum mostly shining, little or no tomentum when viewed from rear; male frons twice the width of anterior ocellus; male outer vertical seta usually present; female rear edge of T5 with cleft (Whitworth 2006, as in fig. 49).

Distribution. Specimens were examined from Dominica (TW), Jamaica (LSAM), and Puerto Rico (TW, FSCA, CMNH, USNM). Dear (1985) did not record it from the West Indies. It is found throughout the Neotropical Region.

Genus *Cochliomyia* Townsend

Species of this genus have a bright orange head with mostly yellow setae. The phallus has a long paraphallus and short, complex hypophallus (Figs. 23–24) (Dear 1985). The ejaculatory sclerite is large and fan-shaped (Figs. 25–26).

Key to species of *Cochliomyia* of the West Indies

1. Genal dilation antero-dorsally with few to many short, black setae (Fig. 21); T5 cupreous, contrasting in color with preceding tergites (Fig. 22); mesonotum with 3 broad black polished vittae alternating with narrower, gray microtomentose vittae (Fig. 5); postgenal setulae white..... 2

- Genal dilation with entirely yellow setae; T5 blue to green, concolorous with preceding tergites; mesonotum with three black polished vittae alternating with about equal width green or blue microtomentose vittae; postgenal setulae yellow 3
- 2. T5 with pair of median dorsal silvery microtomentose spots (Fig. 22); occiput with few to numerous dark setae in upper part, just below postocular setae; frons of male narrower, 0.06 (0.05–0.065/8) head width, equal to or narrower than the width of first flagellomere; surstylus and cercus long and slender (Figs. 31, 33) *C. aldrichi*
- T5 with uniform dusting of microtomentum; occiput with pale setae only below postocular setae; frons of male broader, 0.083 (0.075–0.09/2) head width, width broader than width of first flagellomere; surstylus digitate, cercus with broad base tapering sharply to point (Figs. 32, 34) *C. minima*
- 3. Fronto-orbital plate with dark setulae outside row of frontal setae (Whitworth 2006, fig. 53, right side); T5 without pronounced silvery microtomentum; postgenal setae usually golden yellow; female with dark basicosta; proclinate orbital setae absent; not found in North America since 1966 due to eradication efforts; found in parts of Mexico, Central and South America, possibly in isolated areas in the West Indies *C. hominivorax*
- Lower third to half of fronto-orbital plate with pale setulae outside row of frontal setae (Whitworth 2006, fig. 53, left side); T5 usually with pronounced silvery microtomentum laterally; postgenal setae usually pale yellow; female usually with yellowish basicosta; usually with two pairs of proclinate orbital setae (sometimes only one on one or both sides). Widespread in Neotropical and Nearctic Regions *C. macellaria*

***Cochliomyia aldrichi* Del Ponte**

Figs. 21–23, 25, 27, 29, 31, 32

Cochliomyia aldrichi Del Ponte, 1938: 274

Callitroga aldrichi: Hall, 1948: 123

Cochliomyia aldrichi: Dear, 1985: 137

Diagnosis. This species and *C. minima* are distinctive, because T5 is coppery and the dorsum of the thorax is metallic black with gray stripes. They also share a few to many black setae on the anterior part of the gena (Fig. 21). *Cochliomyia aldrichi* has a pair of median dorsal white spots on T5 (Fig. 22) and few to numerous dark setae on the upper occiput just below the postocular area. Males have an average frons width of 0.06 of head width.

Male genitalia. Surstylus long and slender, expanded distally, cercus tapering gradually from a narrow base to a point (Figs. 31, 32). Phallus has a typical epiphallus, a long paraphallus with an articulated joint near anterior end. Posterior end of paraphallus ends in a complex hypophallus and acrophallus (Fig. 23). Distal end of the ejaculatory sclerite broad and fan-like and narrowing gradually to base (Fig. 25). Pregonite triangular with four setae; postgonite digitate with a single fine seta (Fig. 27). Male abdominal sternites uniform, except ST5 expanded and uniquely-shaped (Fig. 29).

Distribution. Specimens from USNM were confirmed from Anguilla, Nassau and San Salvador in Bahamas, Guana Island and several locations in Puerto Rico and Virgin Islands. Dear (1985) listed this species from numerous locations in the West Indies, including Bahamas, Cuba, Puerto Rico, San Salvador (Bahamas), Virgin Islands, and Cayman Islands.

***Cochliomyia hominivorax* (Coquerel)**

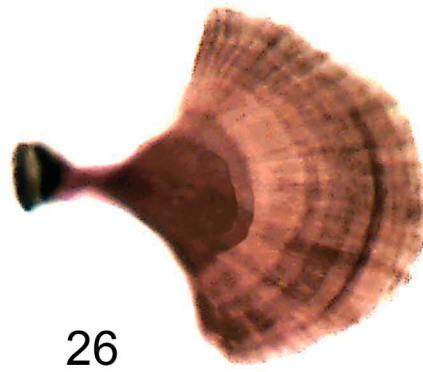
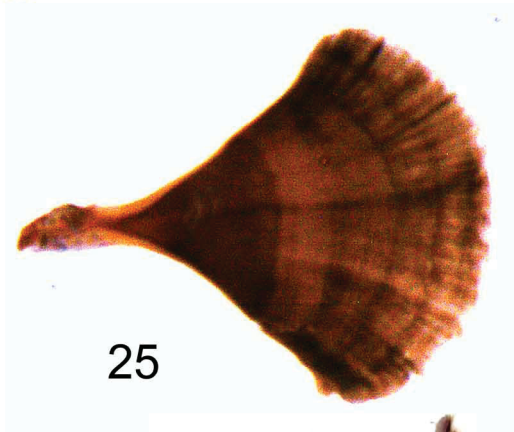
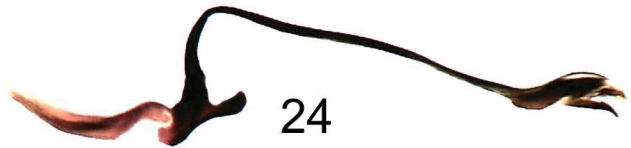
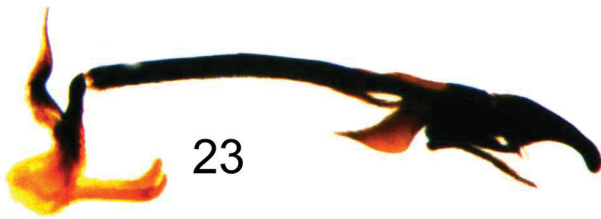
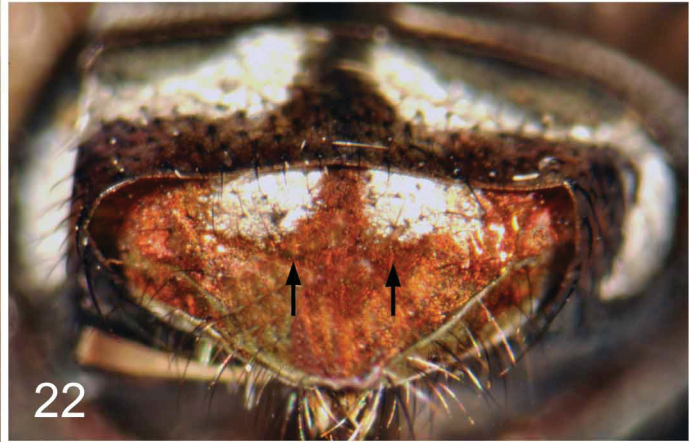
Lucilia hominivorax Coquerel, 1858: 173

Callitroga americana: Hall, 1948: 125

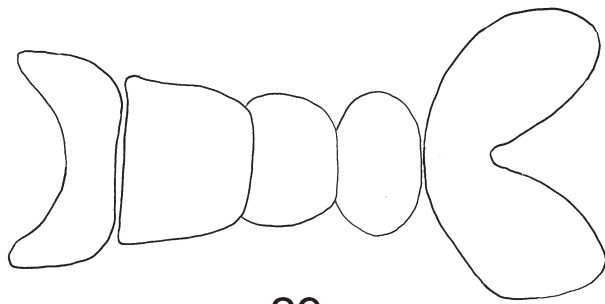
Cochliomyia hominivorax: Dear, 1985: 138

Diagnosis. Fronto-orbital plate with dark setulae outside row of frontal setae (Whitworth 2006, fig. 53, right side); lateral areas of T5 without pronounced silvery microtomentum; postgenal setae usually golden yellow; female with dark basicosta; proclinate orbital setae absent.

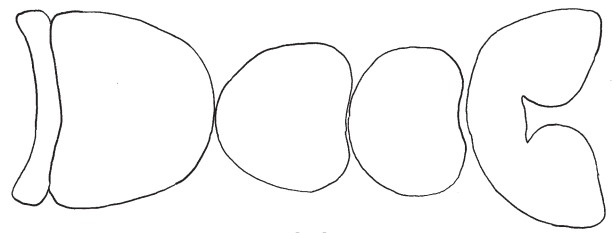
Distribution. Dear (1985) listed this species from numerous West Indies islands. It has been eradicated in most regions, but isolated pockets may exist on remote islands.



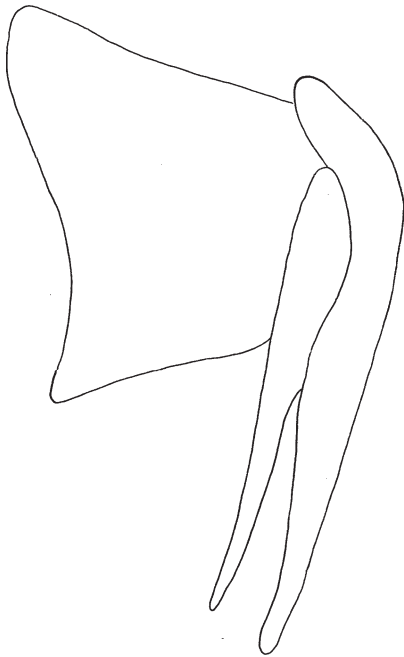
FIGURES 21–28. *Cochliomyia*. 21–23. *C. aldrichi*. 21. Black setae on upper genal dilation. 22. T5 with coppery color and white spots. 23. Left lateral view of phallus. 24. *C. minima*, left lateral view of phallus. 25. *C. aldrichi*, ejaculatory sclerite. 26. *C. minima*, ejaculatory sclerite. 27. *C. aldrichi*, pre- and postgonites. 28. *C. minima*, pre- and postgonites.



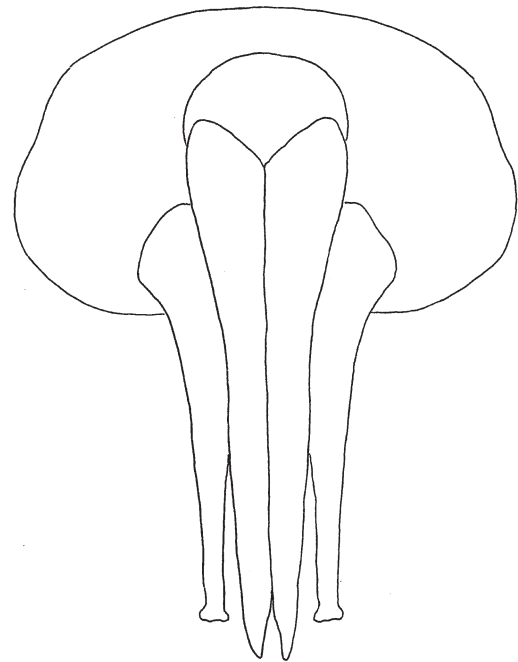
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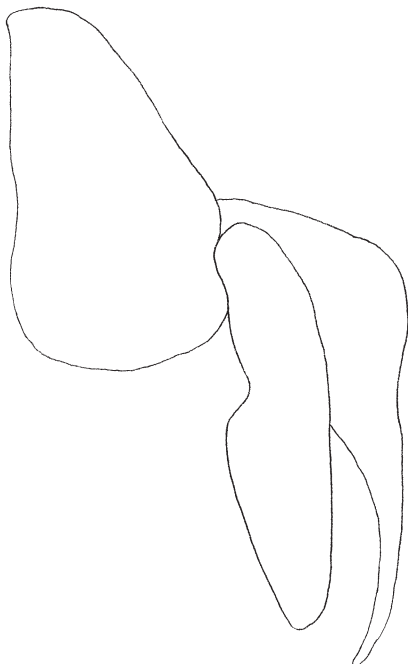
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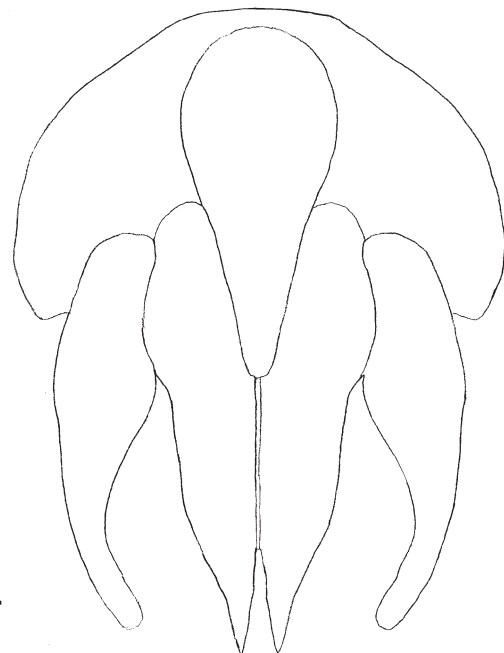
31



32



33



34

FIGURES 29–34. 29. *Cochliomyia aldrichi*, male abdominal sternites. 30. *C. minima*, male abdominal sternites. 31–32. 31. *C. aldrichi*, left lateral view of male genitalia (epandrium, surstylus, and cercus). 32. posterior view of male genitalia. 33–34. 33. *C. minima*, left lateral view of male genitalia. 34. posterior view of male genitalia.

***Cochliomyia macellaria* (Fabricius)**

Musca macellaria Fabricius, 1775: 776

Callitroga macellaria: Hall, 1948: 138

Cochliomyia macellaria: Dear, 1985: 139

Diagnosis. Lower 1/3–1/2 of fronto-orbital plate with pale setulae outside row of frontal setae (Whitworth 2006, fig. 53, left side); T5 usually with pronounced lateral areas of silvery microtomentum; postgenal setae usually pale yellow; female usually with yellowish basicosta; usually with two pairs of proclinate orbital setae (sometimes one or both sides have only one).

Distribution. Dear (1985) listed this species from numerous West Indies islands, and it is common in collections from the region. This species is common and widespread throughout the Nearctic and Neotropical Regions.

***Cochliomyia minima* Shannon**

Figs. 24, 26, 28, 30, 33, 34

Cochliomyia minima Shannon, 1926: 124

Callitroga minima: Hall, 1948: 148

Cochliomyia minima: Dear, 1985: 136

Diagnosis. See comments under *C. aldrichi* regarding characters shared with *C. minima*. T5 with uniform dusting of microtomentum and no visible spots; occiput with pale setae only below postocular setae; frons of male broader, 0.083 (0.075–0.09/2) head width, broader than width of first flagellomere.

Male genitalia. Surstylus short and digitate, the lower end directed somewhat rearward, the cercus has a broad base which tapers sharply to a pointed end (Figs. 33, 34). Phallus has a typical epiphallus, basiphallus has a posteroventral projection; paraphallus long, the anterior end has a 90° bend downward ending in a complex hypophallus and acrophallus (Fig. 24). Ejaculatory sclerite fan-shaped as in *L. aldrichi*, but base has a slender petiole that expands abruptly into a fan (Fig. 26). Pregonite slender with four setae; postgonite digitate with a single fine seta (Fig. 28). Male sternites similar to those in *C. aldrichi*, but ST5 is narrower (Fig. 30).

Distribution. Specimens were examined from Cuba (USNM), Dominican Republic (CMNH), Jamaica (USNM), and Puerto Rico (TW, UPR, CMNH). Dear (1985) listed this species from Jamaica, Dominican Republic, Puerto Rico, Virgin Islands, and Florida Keys. This species is rare in museum collections, but I commonly collected it in tropical habitat on the edge of the University of Puerto Rico campus.

Discussion. Dear listed *C. minima* in the Florida Keys, but he may have been mistaken. A specimen identified by him as *C. minima* in USNM is in fact *C. aldrichi*. I examined numerous *C. aldrichi* from the Florida Keys, but never found *C. minima* there.

Genus *Phormia* Robineau-Desvoidy

***Phormia regina* (Meigen)**

Musca regina Meigen, 1826: 58

Phormia regina: Hall, 1948: 161

Diagnosis. Genal dilation usually dark, with dark setae; head with dark vestiture; posterior margin of hind coxa bare or with weak setae; spiracle with orange lappets. A single widespread species in the Nearctic and Palearctic Regions.

Distribution. A single specimen of *Phormia regina* was collected in Bahamas from Eluethera Island, Rainbow Bay on Oct. 16, 1996 by J.R. Wiley (FSCA). This specimen was collected in a Malaise trap along with one *Pollenia pediculata*. J.R. Wiley (pers. comm.) has confirmed that the sample was not contaminated, so both species have evidently been introduced.

Genus *Hemilucilia* Brauer

This genus is common in Central and South America with six known species.

Hemilucilia segmentaria (Fabricius)

Figs. 6, 7

Musca segmentaria Fabricius, 1805: 292

Hemilucilia segmentaria: Dear, 1985: 127

Diagnosis. Posterior margin of hind coxa setose along entire width (Fig.7); upper facets of male eye not significantly enlarged; ventral surface of costa setulose just to the junction of the subcosta.

Distribution. This species is widespread in South and Central America. Two specimens were identified from Trinidad (USU) and Dear (1985) also recorded it from there. It has not been found elsewhere in the West Indies. It is notable that Trinidad is close to Venezuela where this species is common and quite distant from most other West Indies islands (except Tobago).

Subfamily Luciliinae

Genus *Lucilia* Robineau-Desvoidy

There are four genera in this subfamily but this is the only genus in the New World.

Diagnosis. Ground color shining green, blue, or bronze, though one species, *L. problematica* Johnson is duller colored; suprasquamal ridge posteriorly with a shining sclerite with a cluster of setae; lower calypter bare.

Discussion. In the West Indies there are 10 species of *Lucilia* known, five of which are endemic to the region. Most published accounts on this genus in the Neotropical Region use the synonym *Phaenicia* Robineau-Desvoidy, 1863. *Lucilia* throughout the West Indies can be difficult to identify to species, especially the eight species with two postsutural acrostichal setae that have few distinguishing characters. Specimens are often in poor condition so a subtle character like color can be difficult to interpret. Characters used include color of basicosta and calypter and patterns of microtomentum on abdominal tergites. The distribution of tibial setae is somewhat variable and cannot be relied upon to separate species. The shape of male genitalia tends to be similar among species in this group and is of minimal value to distinguish most *Lucilia* in this area. The ovipositors from species in this group also exhibit little variation between species.

Six little known species were selected to study in detail, comprising *L. chuvia*, *L. eximia*, *L. fayeae*, *L. lucigerens*, *L. retroversa*, and *L. rica*; the latter four known only from the West Indies. For convenience, they are referred to as the *L. eximia* group. In five of the species, the male genitalia, including the epandrium, surstyli, and cerci are densely covered with long curly setae. Only *L. chuvia* has somewhat sparser setae on the male genitalia. The setae are often so dense that it can be difficult to see the surstylus and cercus clearly when they are drawn down in the specimen making it necessary to perform a dissection. The surstylus tends to be digitate, though it is broader and usually sharply turned inward in *L. retroversa* (Fig. 49). Female specimens are even more difficult to distinguish; those in poor condition may be unidentifiable.

Figures and descriptions of the phallus and other male characters and ovipositors for six species of the *L. eximia* group which occur in the West Indies are given. They are surprisingly uniform in appearance so shared characters are discussed here and not repeated under each species.

Male genitalia. The phallus appears to be the same general type for each species; see Fig. 56 for terms. They are closest to the “*L. caesar* type” as described by Rognes (1991). Epiphallus originates toward the anterior end of the basiphallus. Paraphallus long and slender and apically curved down with dentate tips. Hypophallus has low dentate ridges and no projections. Acrophallus long and slender ending in a dentate covered tip. No lateral ducts evident. Pregonite slender, with three setae, the distal seta in the apical position; postgonite has a single basal seta. Ejaculatory sclerite small and slender with a flattened expansion at the end, as in Fig. 64.

Variation in surstyli. In the process of describing two new species of *Lucilia* (*L. lucigerens* and *L. retroversa*) from the West Indies, James (1971) identified a character he described as “geniculate outer forceps.” In this condition, surstyli curve sharply inward midway to about a 90° angle similar to the condition shown in Fig. 49. When this study was begun, this character was observed in specimens of other species of *Lucilia* in the region, including *L. cluvia*, *L. eximia*, *L. fayeae* and *L. rica*. Initially it was suspected that *L. cluvia*-like specimens in the region belonged to a separate species from those in North America based in part on this condition. Unfortunately it proved to be highly variable within species, and the sharp bend disappeared when specimens were heated in KOH and dissected. *Lucilia retroversa* was more likely to retain a distinctive bend than the other species though even that was variable (Fig. 49).

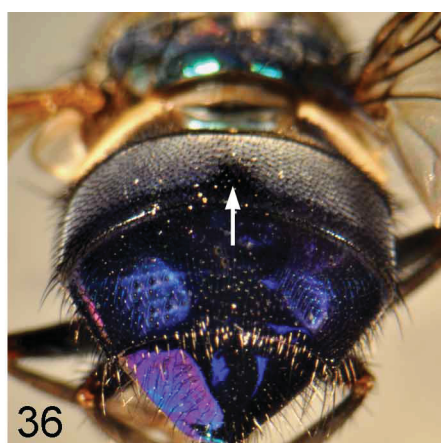
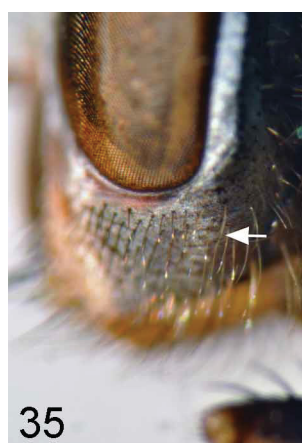
I have concluded that the bend in the surstyli is not useful for species distinctions because it is too variable and probably caused by environmental factors. In hot, humid climates, many collected specimens of *Lucilia* are very moist and often appear teneral. I suspect that the drying process in recently killed specimens can sometimes lead to the warping of the surstyli. I also observed this condition in some specimens of *Lucilia* from the Florida Keys and Central America.

Female genitalia. Ovipositors in the *L. eximia* group are composed of three segments, 6, 7 and 8. T6 is one complete sclerite, while T7 and T8 are more or less divided; sternites are single sclerites. Epiproct, hypoproct and cerci similar in all six species; see Fig. 88 for characters and see ovipositor figures cited under each species. T6 broad, with paired spiracles and a strong row of setae on the rear margin, and no microtrichia on this tergite in any of the species. ST6 tends to be pear-shaped with dense setae on the rear third or more, and microtrichia are present on the rear portion of this sternite in all species. A dashed line on the rear of ST6 in each figure shows how far forward the microtrichia are found. T7 separated by a membranous area that extends nearly to the rear of the tergite with a row of setae on the posterior margin. ST7 elongate, often a little longer than T7 with a row of strong setae at the rear. T8 divided into two distinct tergites, each section with strong setae posteriorly. ST8 longer than T8 with a strong row of setae posteriorly. Epiproct, cerci and hypoproct covered with setae and microtrichia. Intersegmental and most pleural membranes have microtrichia which are directed forward and vary in shape by segment; selected areas are shown in each figure.

Key to the species of *Lucilia* of the West Indies

1. Three postsutural acrostichal setae; abdomen usually with apparent mesal division in which one half is microtomentose, the other half shining when viewed from a sharp angle laterally 2
- Two postsutural acrostichal setae; abdomen usually uniformly metallic or microtomentose 3
2. Central occipital area with single seta just below inner vertical seta (Whitworth 2006, fig. 73); abdomen dull coppery; humeral callus with two or three small setulae along posterior margin (Whitworth 2006, fig. 74); metasternum bare; frons of male broad, much broader than width of parafacial at level of lunule, 0.20 (0.19–0.21) of head width; male genitalia (under *Phaenicia pallescens*) as in Hall (1948, fig. 24, J–M) *L. cuprina*
- Central occipital area with two to five setae below inner vertical seta (Whitworth 2006, fig. 73); abdomen usually bright green, occasionally shining coppery; humeral callus with six to eight small setulae along posterior margin (Whitworth 2006, fig. 74); metasternum setose; frons of male narrower, about equal to width of parafacial at level of lunule, 0.13 (0.12–0.14) of head width; male genitalia as in Hall (1948, figs. 25 F, G); reported only from Bermuda. *L. sericata*
3. Fifth abdominal tergite coppery or aeneous (not always obvious, especially in some females); postocular area golden; body dark blue, sometimes with purple highlights; upper calypter white, lower calypter tan in both sexes;

- basicosta tan; anterior abdominal tergites with tomentum including outer edges of T4, the remainder polished; known only from Jamaica..... *L. lucigerens*
- T5 usually not distinctly colored in contrast to other tergites; without above combination of characters. 4
 - 4. Rear half of gena with several to many pale setae in front of postgena (Fig. 35) (note the postgena has pale setae in all *Lucilia* in the region)..... 5
 - Rear half of gena with only dark setae (rarely a few pale setae are found on rear edge of gena, not extending forward)..... 6
 - 5. Basicosta usually tan, sometimes light tan to orange. Rear edge of T3, all of T4 and T5 polished when viewed from rear (Fig. 36); male frons narrow, about 0.03 of head width, much narrower than width of first flagellomere. *L. rica*
 - Basicosta usually pale yellow or orange. Anterior third or more of T4 with whitish microtomentum, rest of T4 and T5 polished (Fig. 37); male frons much broader, about 0.10 of head width, broader than width of first flagellomere. *L. cluvia*
 - 6. Basicosta pale orange, yellow or whitish..... 7
 - Basicosta darker, tan to black or sometimes orange-brown 9
 - 7. Body color metallic-tan, appearing somewhat teneral; abdominal tergites all microtomentose; known only from six specimens from Bermuda, possibly extinct *L. problematica*
 - Body color shining green, blue, or violet; T5 shining with no microtomentum..... 8
 - 8. Thorax green or blue, abdomen bluish-purple; T4 and T5 polished; male lower calypter dark brown; setae behind postocular row of setae weak and pale; surstyli broad, usually curved sharply inward (Figs. 48–49); known only from Bahamas, Cuba, Cayman Islands and Dominican Republic..... *L. retroversa*
 - Thorax and abdomen normally concolorous brilliant green; only rear edge of T4 and all of T5 polished; male lower calypter light tan; one irregular row of black setae behind postocular row; surstylus long and slender (Figs. 40–41); listed from Cuba by James (1970), primarily southern USA, possibly introduced elsewhere *L. coeruleiviridis*
 - 9. Upper and lower calypters gray to tan in both sexes; postocular area golden in good specimens, varying from faint to bright yellow; area may be darkened in poor specimens. Male frons narrow, 0.02 head width, usually less than width of median ocellus; male genitalia as in Figs. 44–45; known only from Puerto Rico, St. Vincent, Dominica and St. Lucia *L. fayeae*
 - Upper calypter pale both sexes, lower calypter brown in male and whitish in female; postocular area usually bright silvery. Male frons broader, 0.03–0.05 head width, usually wider than median ocellus; male genitalia as in Figs. 42–43..... 10
 - 10. Most or all of abdominal T4 polished when viewed from rear; throughout the West Indies West Indies variant of *L. eximia*
 - Only rear half of T4 polished when viewed from rear; Trinidad and mainland areas (North, South and Central America)..... Mainland variant of *L. eximia*



FIGURES 35–37. *Lucilia* characters. 35. *L. cluvia*, pale setae on rear of gena. 36. *L. rica*, tomentum pattern on abdomen. 37. *L. cluvia*, tomentum pattern on abdomen.

***Lucilia cluvia* (Walker)**

Figs. 35, 37–39, 52–53, 64–66, 82, 89

Musca cluvia Walker, 1849: 885

Phaenicia cluvia: Hall, 1948: 236

Lucilia cluvia: Whitworth, 2006: 720

Diagnosis: Male with exceptionally broad frons, 0.12 (0.10–0.13)/13 of head width; female with frons 0.29 (.28–.30)/4. Basicosta usually pale; upper and lower calypter white to yellowish in both sexes; pale setae on lower genal dilation. Pattern of setae on tibia t1, 1p; t2, 1ad, 1av; t3, 2 pv to pd. Male genitalia in lateral view with surstylus digitate, parallel sided, lower half curving slightly forward; cercus straight with a broad base tapering evenly to a narrow point, about equal in length to surstylus. In posterior view, lower surstylus and cercus curving inward. Setae on the epandrium, surstylus and cercus much sparser in this species than in the rest of the *L. eximia* group. Phallus and other male characters and ovipositor are typical for the *L. eximia* group (Figs. 52–53, 64–66, 82, 89).

Distribution. This species is rare, but specimens were seen from several locations in Puerto Rico (CMNH, FSCA, UPR, USNM) including Mayaguez, San Juan, Toa Baja, Fort of France, and also from Martinique (CNC), Havana, Cuba (USNM) and possibly Anguilla (CNM) (see comments below). It is also found in the southeastern USA where it is generally rare, though many specimens were examined from the Florida Keys (FSCA). Specimens also were examined from Mexico, Guatemala, Honduras and Costa Rica, and Mariluis *et al.* (1994) recorded it from Argentina.

Discussion. The pale setae on the lower gena are a good character to separate both sexes of this species from most other West Indies *Lucilia* (except *L. rica*). Care must be taken not to confuse similar pale setae on the postgena with those on the gena. In this species the setae on the lower gena are usually a mix of pale and dark setae and they must be examined carefully in good light. This species is very similar in appearance to *L. rica*. Males are readily distinguishable by their exceptionally broad frons which is 0.11 of head width (broader than width of first flagellomere), which is unique for Neotropical *Lucilia* with two postsutural acrostichal setae. Frons width in *L. rica* is much narrower, averaging 0.02–0.03 of head width (much narrower than first flagellomere). *Lucilia cluvia* has a pale basicosta versus a brown basicosta in *L. rica*. Basicosta color alone is not always reliable to separate these species as basicosta discoloration (darkening) may occur in *L. cluvia*. Also some *L. rica* have a lighter-colored basicosta, from light brown to orange-brown. *Lucilia cluvia* also has tomentum on the upper third or more of T4 (Fig. 37) while that area is polished in *L. rica* (Fig. 36). A single female from Anguilla (CNC) is in such poor condition that I cannot be sure if it is *L. cluvia* or *L. rica*. It is included here because it has a pale basicosta, though more collections from Anguilla are needed to determine which species are present there.

***Lucilia coeruleiviridis* Macquart**

Figs. 40–41

Lucilia coeruleiviridis Macquart, 1855: 522

Phaenicia caeruleiviridis: Hall, 1948: 232

Lucilia coeruleiviridis: Whitworth, 2006: 720

Diagnosis. Male frons 0.023 (0.015–0.030)/8 of head width; female frons 0.25 (0.24–0.26)/4. Rear of the head has a row of irregular black setae behind the postocular row. Basicosta pale; upper calypter pale in both sexes, lower light tan in males and pale in females; only rear edge of T4 and T5 polished. Male genitalia in lateral view with surstylus slender and curved forward, narrowing evenly to distal end; cercus narrowing distally to a point, curved forward, about equal in length to surstylus. In posterior view, surstylus curved inward, cercus tapering from a broad base to a point (Figs. 40–41).

Distribution. No specimens were seen in collections from the region, but James (1970) listed it as occurring in Cuba. It is common in southeastern USA and I also have seen it from Guatemala.

Comment. Hall (1948) misspelled the species name as “*caeruleiviridis*” in his publication. In Macquart’s (1855) original publication, the way the word is printed in the diagnosis with the o and e joined as “œ” may have led to confusion about spelling.

***Lucilia cuprina* (Wiedemann)**

Musca cuprina Wiedemann, 1830: 654

Phaenicia pallescens Hall, 1948: 247

Lucilia cuprina: Whitworth, 2006: 720

Diagnosis. This species has three postsutural acrostichal setae, a character shared only with *L. sericata* in the region. It also has a distinctive dull coppery coloration. Male frons broad, 0.20 (0.19–0.21)/7 of head width; female frons 0.39 (0.38–0.40)/5. Central occipital area with a single seta below inner vertical seta (Whitworth 2006, fig. 73); abdomen a dull, coppery color.

Distribution. Specimens were seen from Cuba (USNM, FSCA), Haiti (FSCA), Jamaica (USNM), Puerto Rico (WSUP), Trinidad (FSCA), and Virgin Islands (FSCA). Woodley and Hilburn (1994) listed it from Bermuda (USNM).

***Lucilia eximia* (Wiedemann)**

Figs. 42–43, 54–55, 67–69, 83, 90

Musca eximia Wiedemann, 1819: 53

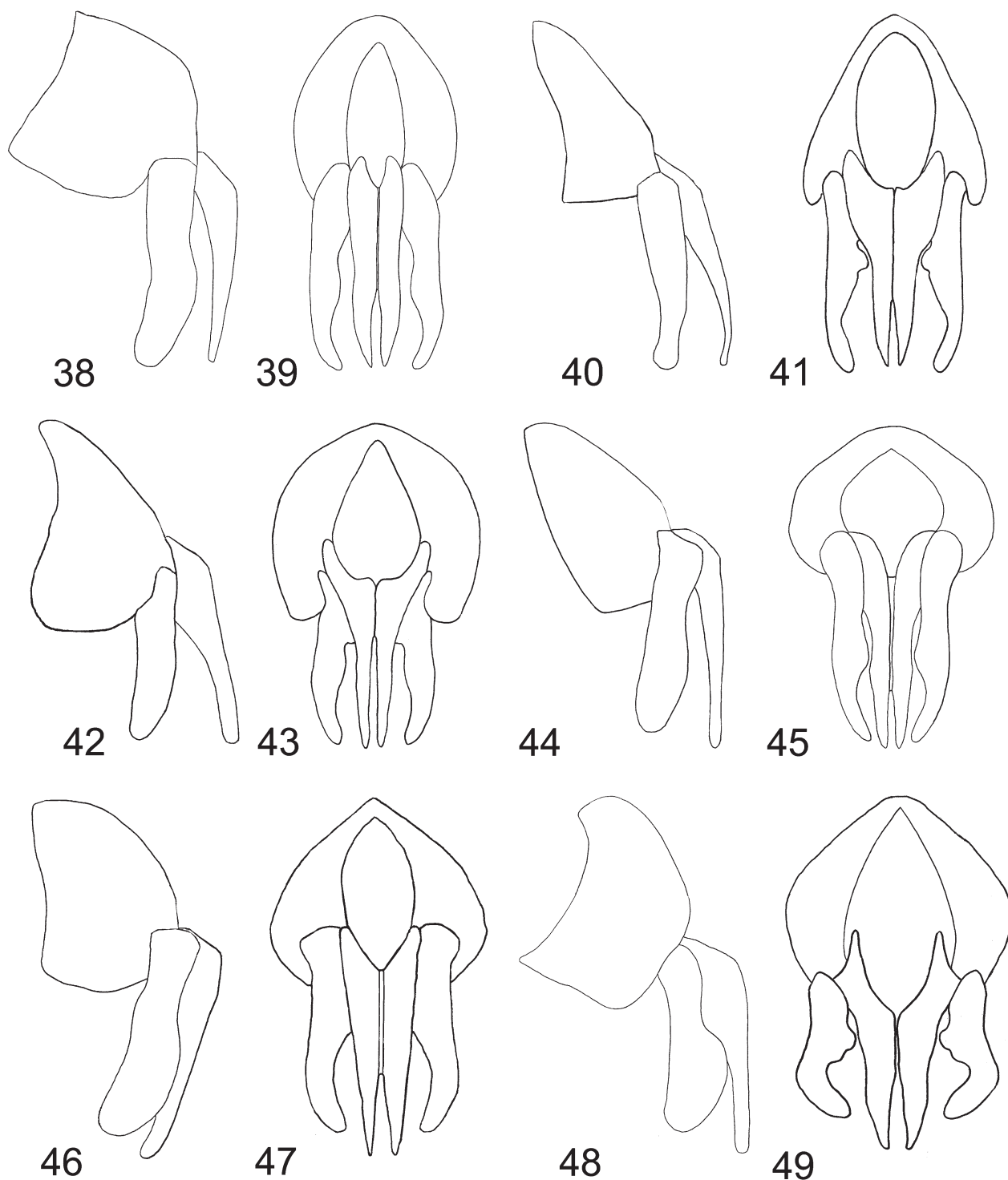
Phaenicia eximia: Hall, 1948: 239

Lucilia eximia: Whitworth, 2006: 730

Diagnosis. Male frons 0.035 (0.03–0.05)/19 of head width, female frons 0.25 (0.24–0.28)/11. Basicosta tan; upper calypter pale both sexes, lower calypter brown in male, white in female; setal patterns on tibia are t1,1 pv; t2 1 or 2 v to av; t3 2 p to pv. Male genitalia in lateral view with surstylus digitate, slightly curved forward; cercus with broad base and narrowing distally to a point, slightly longer than surstylus. In posterior view, surstylus curved inward; cercus tapering from broad base to a point (Figs. 38, 39). Phallus and ovipositor and other characters as described above for the *L. eximia* group (Figs. 54–55, 67–69, 83, 90).

Distribution. Specimens of *L. eximia* were examined from numerous locations in the West Indies, including Barbados (BMNH, USNM), Dominica (TW), Dominican Republic (CMNH), Grenada (FSCA), Guadeloupe (CNM), Puerto Rico (CNM, FSCA, TW, UPR, USNM), St. Vincent (CNM, USNM), Trinidad (BMNH, CNM, FSCA, USNM, USU) and Virgin Islands (FSCA). Despite being widespread, this species is generally less common than some other *Lucilia*.

Variation. Previous researchers, James (1967) and Woodley and Hilburn (1994), have noted that *L. eximia*-like specimens in the region do not match the mainland *L. eximia*. I came to the same conclusion after examining specimens from numerous areas throughout the region. After extensive study, only one consistent character was found that distinguishes the island specimens from those on the mainland. In island specimens, almost all of T4 is polished while in the mainland form the front 2/3 or more of T4 is microtomentose. A long series of specimens from Trinidad, which is close to the shore of Venezuela, is like the mainland form. Other than nearby Tobago, it is distant from other West Indies islands. For the rest of the region, the specimens are like the island form. Between islands there is considerable variation in vestiture color of the postoccipital area, fronto-orbital plate and parafacial. Color combinations varied from silver-silver to silver-gold to gold-silver. Also encountered were a number of specimens with a brilliant gold body color. A long series from Barbados initially led me to suspect a new species, but a detailed study of genitalia and other characters did not provide sufficient differences to justify new species status.



FIGURES 38–49. Left lateral and posterior views of *Lucilia* male genitalia. **38, 39.** *L. chuvia*. **40, 41.** *L. coeruleiviridis*. **42, 43.** *L. eximia*. **44, 45.** *L. fayeae*. **46, 47.** *L. lucigerens*. **48, 49.** *L. retroversa*.

***Lucilia fayeae* sp. nov.**

Figs. 44–45, 56–57, 70–72, 84, 91, 95

Diagnosis. A small, nondescript *Lucilia* easily confused with similar species; length averaging about 6mm (5–7.75) (Fig. 95). Both sexes blue to green in color, often with pink to purple highlights; many specimens

appear teneral and pinned specimens are often distorted; fronto-orbital, upper parafacial and postocular areas with predominantly pale to bright gold color in good specimens though these areas can darken in poor specimens; upper and lower calypters gray to tan or dark brown in both sexes, all other known *Lucilia* in the region have a pale upper calypter. Male frons exceptionally narrow, averaging 0.02 of head width, narrower than width of median ocellus; fronto-orbitals meet midway on the frons.

Description. Male. Head dark in ground color, postocular, fronto-orbital, and parafacial areas with pale to bright yellow-gold microtomentum when viewed from above; frontal vitta dark reddish; ocellar triangle small; frontal setae ascend to about midway to vertex where fronto-orbitals meet; antenna gray, pedicel dark brown with orange base; gena with black ground color with silvery microtomentum and black setae, postgena with pale setae; eyes with inner facets about twice diameter of outer facets; occiput with fine, pale setae; palp orange. Thorax blue to green color; presutural area of pronotum with whitish tomentum when viewed from rear, bare shining areas on posterolateral corners; postsutural area mostly polished, anterolateral areas with whitish tomentum; scutellum shining; notum with setal pattern typical for genus; thoracic spiracles brown to dark brown; proepisternal area with silvery vestiture and pale setae. Legs tan in color with a setal pattern on tibia as follows, t1 1p; t2 1a, 2p, 1v; t3 no pronounced setae. Wings hyaline, bases slightly infuscated; basicosta tan to brown; upper and lower calypters and rims usually gray to tan, sometimes color washed out in poor specimens. Abdomen blue to green, often with pink to purple highlights; T1+2 and T3 with whitish microtomentum when viewed from rear; Puerto Rican and St. Vincent specimens with all of T4 and T5 polished; Dominica and St. Lucia specimens with only rear of T4 and all of T5 polished.

Frons narrow, 0.02 (0.02–0.03/16) head width, 0.41 (0.33–0.55/15) ocellar span, and 0.32 (0.25–0.38/16) first flagellomere. Fronto-orbital plates touching on upper half. Parafacial, at widest, 2.4 (2.0–2.75/16) head width, 0.75 (0.63–0.85/16) first flagellomere, 0.95 (0.9–1.2/15) ocellar span, and 0.25 (0.21–0.28/16) vibrissal interval; cheek width 0.34 (0.32–0.38/16) eye height.

Genitalia in lateral view with surstylus straight, digitate, expanded slightly in distal half; cercus with narrow base, tapering to a point, longer than surstylus. In posterior view, surstylus curved inward; cercus with gradual taper to a broad point (Figs. 44–45). Some specimens with geniculate surstylus. Phallus and other characters are typical for the *L. eximia* group (Figs. 56–57, 70–72, 84).

Female. Features very similar to male. Frontal setae ascend to vertex; upper half of frontal-orbital plate with a patch of dark setulae on each side of ocellar triangle, lower half with fine pale setulae. Frons 0.25 (0.22–0.27/16) head width, 3.8 (3.2–4.3/16) ocellar span, 2.6 (2.2–3.1/16) first flagellomere. Parafacial 0.35 (0.30–0.40/16) frons width, 0.90 (0.72–1.1/16) first flagellomere, 1.3 (1.1–1.6/16) ocellar span, 0.37 (0.35–0.40/16) vibrissal interval; cheek width 0.37 (0.35–0.40/16) eye height. Ovipositor (Fig. 91) very similar to other *Lucilia* in *L. eximia* group.

Type material. Holotype male, allotype female and 85 paratypes (42 males and 43 females) from Dominica, West Indies: St Andrew Parish, near Calibishe, 15°35'28"N 61°20'09"W, March 17, 2009, trap baited with dead fish, T.L. Whitworth. Holotype and allotype deposited in USNM, additional paratypes deposited there and in BMNH, CAS, CMNH, CNC, FSCA, JC, KR, TW, UCD, UGG, UPR, USU, WSUP.

Additional paratypes. Dominica (21 males and 38 females): 3 males, 3 females, Clark Hall Estate, May 16, 1966, G. Steyskal on human feces (USNM); 2 females, Neba., May, 1909, Dr. H.A.A. Richolls (BMNH); 1 female, Parish of St. David, Emerald Pool Natl. Park, 580m, Malaise in humid forest, 18–21 March, 2003, 15°22'8"N 61°20'5"W, M.E. Irwin, M.B. Shepard, E. Benson, G. Carner (KR); 14 males, 12 females, Parish of St. Joseph, Springfield Estate, 15–20 March 2003, 430m, 15°20'8"N 61°22'1"W, M.E. Irwin, E. Benson, G. Carner (KR, USU); 1 male, 10 females, Parish of St. Mark, 1 km W Pte. Guingnard, 15°14'6"N 61°22'3"W, Malaise in dry wash of deciduous forest, 100m, 17–19 March, 2003, M.E. Irwin, M.B. Shepard, E. Benson, G. Carner (KR); 1 female, Parish of St. Paul, nr Pont Casse Trail to Morne Trois Pitons; 15°22'8"N 61°20'5"W Malaise in humid forest, 750m, 3/18/2003, M.E. Irwin, M.B. Shepard (KR); 1 female, Parish of St. Paul, Springfield Estate, 2.5 km e ne Canefield, 15°21'N 61°22'W, 11–18 June, 1991, J.E. Rawlins, S.A. Thompson (CMNH); 1 male, 1 female; Parish of St Paul, ATREC, Springfield Plantation, 15°20'54"N 61°22'04"W, 2 June 2006, yeast and NH₄CO₃ in bait trap, J.A. Cammack (JK); 1 male, 4 females, Parish of St Peter, Anse Multare Ravine, 2km s Dublane, 15°30'3"N 61°27'8"W, 50m, dry deciduous forest, Malaise trap in dry wash, 15–19

March, 2003, M.E. Irwin, M.B. Shepard, E. Benson, G. Carner (KR); 1 female, Morne Diablotin Natl Park Road to Snyder's Trail, 15°31'23"N 61°24'57"W, 27 May, 2006, J.A. Cammack (JK); 1 male; St. Paul Parish, ATREC, Springfield Station, 2 June, 2006, J.A. Cammack (JK); 2 females; Syndicate Trail, Tac #7, trail to Morne Diablotin; 2006 (no specific date), J.A. Cammack (JK). **Puerto Rico** (20 males, 49 females): 1 female, Adjuntas, June 2, 1915, R.H. Von Zwahlenburg (USNM); 1 female, Cayey Bosque Estatal de Carie, 4.2 km se Campamento Guavate, 18°05'25"N 66°02'07"W, 580m, 7 June, 1996, C. Young *et al.* (CMNH); 1 female, El Yunque, May 20–22, 1954, J. Maldonado and S. Medina (UPR); 1 male, Isabela-Bosque Estatal de Guajataca, Montañas Aymamom forest, 18°26'06"N 66°57'55", 210m, 14–15 June, 1966, J. Rawlins *et al.* (CMNH); 1 male, 5 mi NE Jayuya, July 17–19, 1969, H. and A. Howden (CNC); 2 females, Loiza-Bosque Estatal de Pinones, 7.5 km wnw Loiza, 18°28'10"N 65°56'27"W, mangroves, sea level, 18 June, 1996, W. Zanol *et al.* (CMNH); 4 females, Mayaguez, Aug 1–31, 1958, J. Maldonado, Capriles collection; 1 male, Mira, 10–24 Nov., no year, H. Seda (UPR); 1 female, Mayaguez, Sept–Nov., 1965, A. Ruiz Seda (UPR); Mayaguez, 14 Nov., 1981, R.A. Oliveri (UPR); 1 male Mayaguez, Univ. Puerto Rico Campus, Finca Alzamora, Nov. 20–26, 2006, insect net, 18°02'57"N 67°08'26"W, S. Youseff (UPR); 16 males, 36 females, Mayaguez, Univ. of Puerto Rico campus, 18°13' 16"N 67° 08' 74"W, 3 March, 2009, T.L. Whitworth (TW); 2 females, Rio Grande, El Verde Station, 3.1 km wnw Pico El Yunque, Sierra de Luquillo, 18°19'15"N 65°49'11"W, 3–6 June, 1996, C. Young *et al.* (CMNH); 1 female, San Germán, Nov. 10, 1967, T.E. Rogers collection (BMNH). **St. Lucia** (1 female): Saltibus Trail, 460m, 24 Dec., 2002, S. A. Marshall (UGG). **St. Vincent** (3 males, 6 females): 2 males, Montreal, 26 March, 1989, Wayne Mathis (USNM); 1 male, Montreal, 13°12'N 61°11'W, 3 June, 1991, W.N. and D. Mathis (USNM); 5 females, Majorca, July 7–8, 1972, Malaise trap, A.D. Harrison (CMNH); 1 female, leeward side, 1907, H.H. Smith (BMNH).

Non Paratypes. Some specimens were discolored or distorted and thus not labeled paratypes. From Dominica there were 9 males and 35 females, Puerto Rico, 2 males and 13 females.

Specimens examined. 98 males, 186 females, including non paratypes.

Distribution. Known only from Dominica, Puerto Rico, Saint Vincent, and Saint Lucia, but likely on nearby islands.

Ecology and biology. This species is widespread, but most abundant in pockets of humid jungle, often near water. I trapped it on the University of Puerto Rico campus along with numerous *Cochliomyia minima*. Its life history is unknown, but it was attracted to carrion. Examined specimens were collected from a variety of habitats both moist and dry and at elevations as high as 500m.

Variation. Specimens from Dominica and St. Lucia have T4 with whitish microtomentum on the front half to 2/3 while those from Puerto Rico and St. Vincent have all of T4 polished. It is surprising that St. Vincent specimens are like those in Puerto Rico as the island is much closer to Dominica and St. Lucia. Despite this distinction, the specimens are otherwise virtually identical. Occasional specimens of both sexes are seen with the fifth abdominal tergite coppery as in *L. lucigerens* (James), but the darker upper calypter in *L. fayeae* separates it.

Etymology. The species name was chosen to honor my wife Faye who has accompanied and assisted me on numerous collecting trips over the past 40 years.

***Lucilia lucigerens* (James)**

Figs. 46–47, 58–59, 73–75, 85, 92

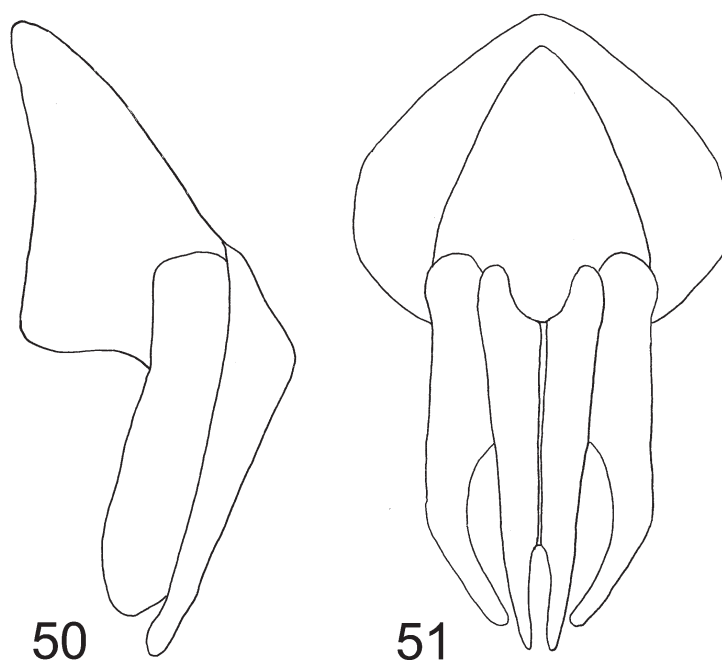
Phaenicia lucigerens James, 1971: 384

Diagnosis. Male frons narrow with fronto-orbitals touching, 0.023 (0.02–0.03)/5 of head width; female frons 0.246 (0.24–0.25)/5 of head width. Pattern of setae on tibia, t1 1p; t2 1ad to av, 1v; t3 no strong setae. Basicosta brown; upper calypter pale with yellow rim, lower calypter light tan in both sexes. Fifth tergite coppery to aeneous in both sexes; this character distinctive in most specimens, though sometimes color can be faint, especially in a few females. A few *L. fayeae* may exhibit this character, but both upper and lower calypters are dark and this species is not known from Jamaica. Some *L. eximia* are coppery, but the color is not

limited to T5. If the aeneous tergite and other characters are missed it will key to *L. eximia*. Presutural area of thorax microtomentose except for posterolateral corners shining. Abominal tergites microtomentose to rear edge of T3, T4 and T5 polished, tomentum sometimes stops short of the end of T3 or extends to front edge of T4.

Male genitalia in lateral view with surstylus short, digitate, base narrow, distal two-thirds expanded, curved slightly forward; cercus broad base, tapering evenly to narrow point, longer than surstylus. In posterior view, surstylus curved inward, cercus long and straight (Figs. 46, 47). Phallus and other male characters and ovipositor are typical for the *L. eximia* group (Figs. 58–59, 73–75, 85, 92).

Distribution. This species is known only from Jamaica (LSAM, USNM, WSUP).



FIGURES 50–51. Views of *Lucilia rica* male genitalia. 50. Left lateral. 51. Posterior.

Lucilia problematica Johnson

Fig. 96

Lucilia problematica Johnson, 1913: 448

Phaenicia problematica: Hall, 1948: 253

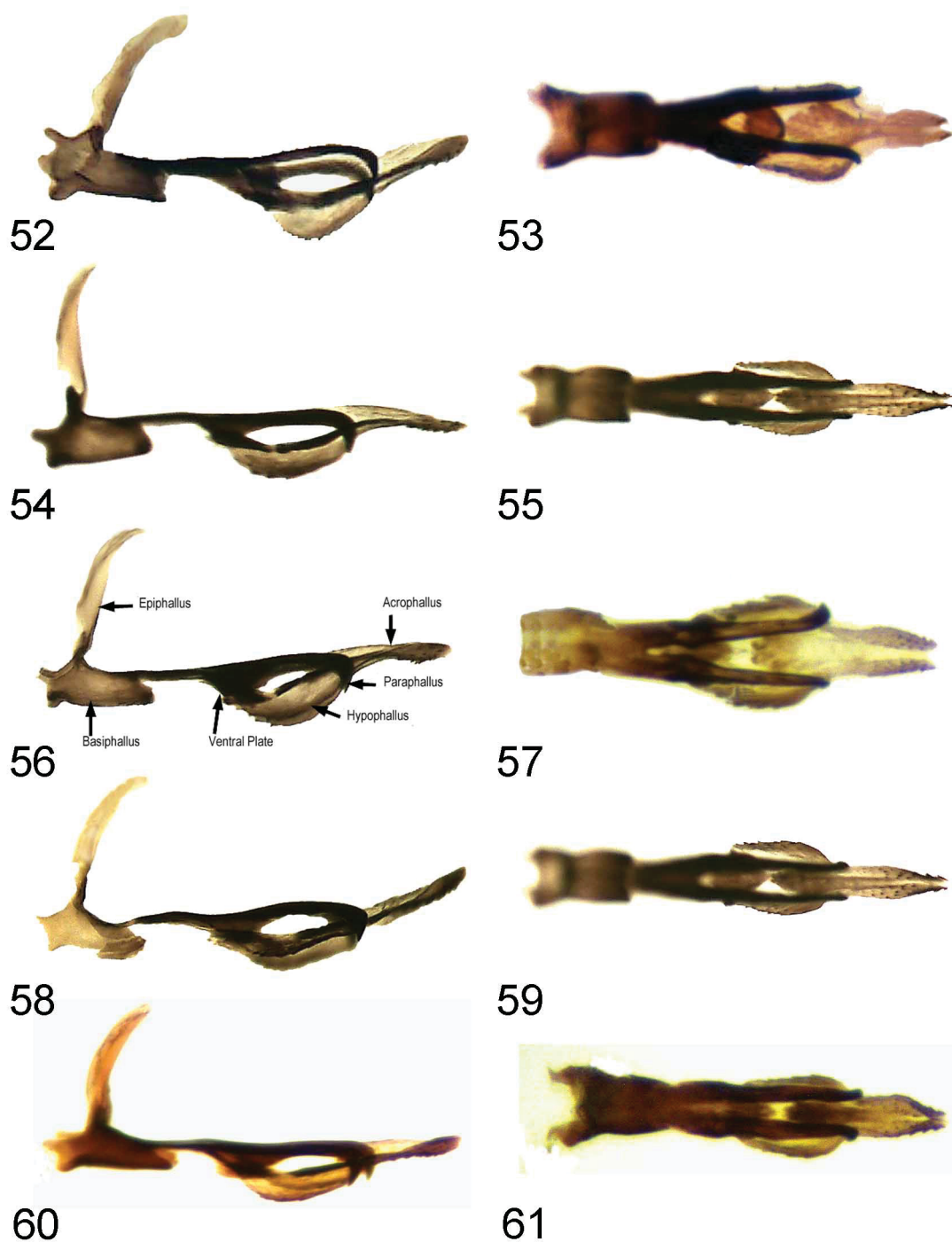
Lucilia problematica: Woodley and Hilburn, 1994: 13

Diagnosis. Body color dark, with olivaceous green luster (Fig. 96). Male frons 0.02 of head width, male not examined (data for male from Hall 1948); surstylus and cercus illustrated in Hall 1948, figs. 25, A, B; female frons 0.30 (0.29–0.31)/2 of head width. Basicosta orange; male upper and lower calypters orange-brown; female upper calypter pale with tan rim lower calypter tan. Setal pattern of tibia on female, t1 1p; t2 1v, 1ad, 1p; t3 no strong setae.

Distribution. This species is known only from Bermuda.

Discussion. To my knowledge, only six specimens are known. Johnson (1913) described this species based on four specimens, two males and two females. Although a holotype was designated, all four specimens were labeled as cotypes. A male in good condition in USNM is clearly the holotype based on collection date and collector. The three paratypes are in MCZ. I did not examine specimens from the type series, but examined two female specimens (collected in 1934) from the Melander Collection (USNM). This species may now be extinct (Woodley and Hilburn 1994). It lacks the normal shining metallic coloration of most *Lucilia*.

As Hall (1948) noted, the thorax and abdomen are dark with metallic olivaceous green luster and bronzy reflections that resemble *L. graphita* Shannon, described from the Hawaiian Islands.



FIGURES 52–61. Phallus of *Lucilia* species in left lateral and dorsal views. **52, 53.** *L. cluvia*. **54, 55.** *L. eximia*. **56, 57.** *L. fayeae*. **58, 59.** *L. lucigerens*. **60, 61.** *L. retroversa*..

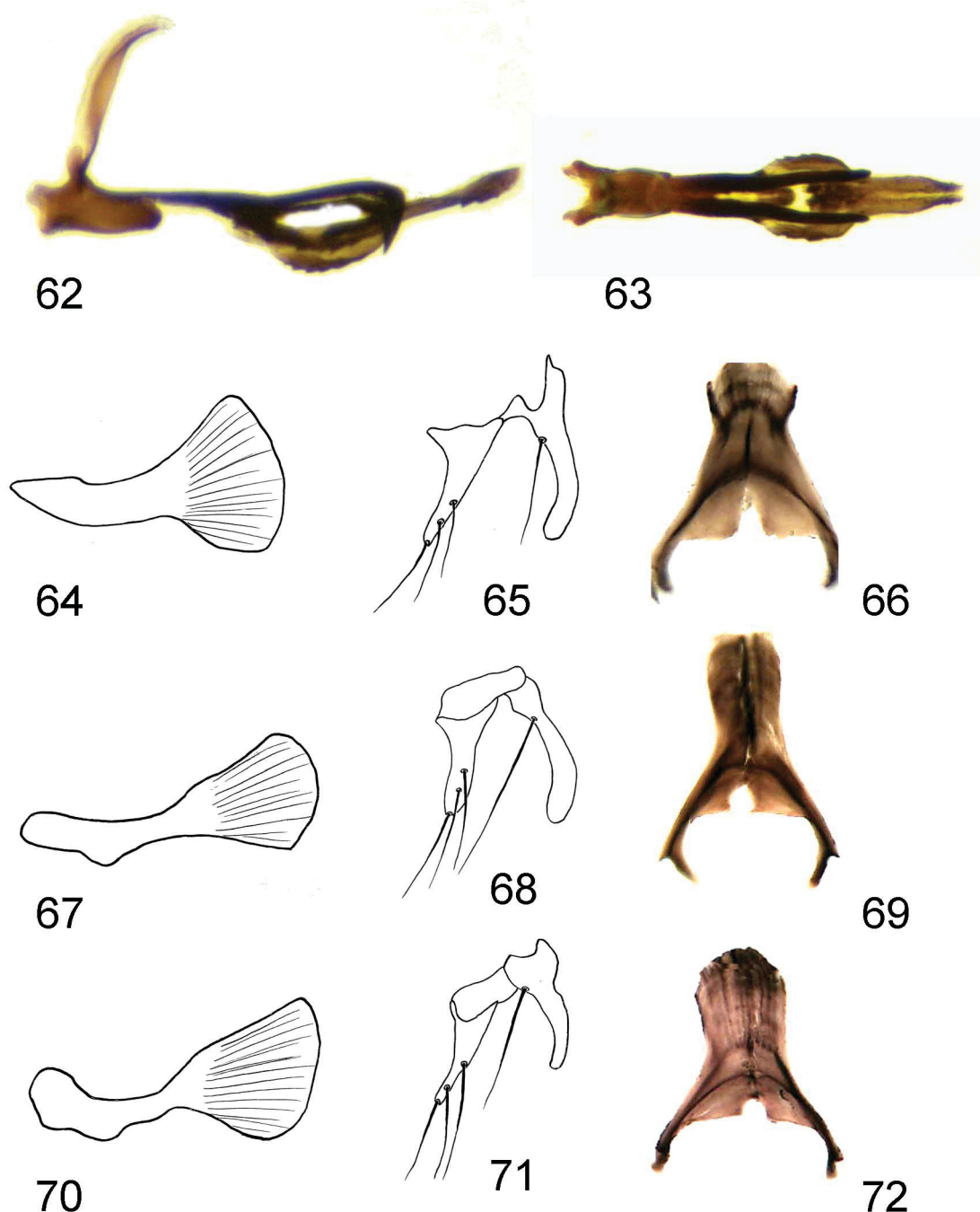
***Lucilia retroversa* (James)**

Figs. 48–49, 60–61, 76–78, 86, 93

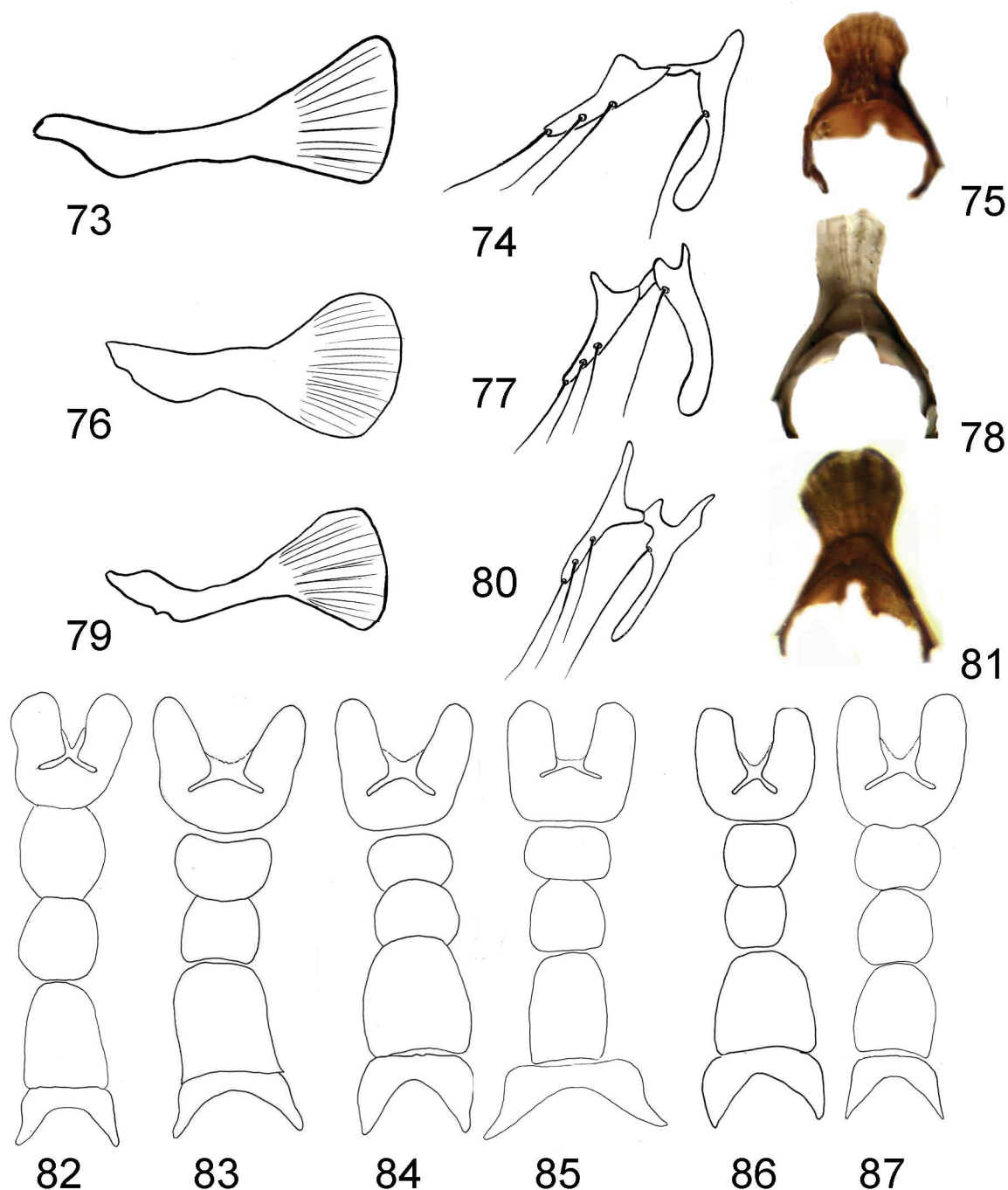
Phaenicia retroversa James, 1971: 382

Diagnosis. Male frons narrow, 0.025 (0.02–0.03)/7 of head width; female frons 0.26 (0.24–0.28)/10. Basicosta pale yellow to orange, inner edge sometimes tan. Male upper calypter light tan to whitish, lower

calypter light tan to brown; female with upper and lower calypters white. Setae on tibia, t1 1p; t2 1ad, 1av, 1p to pv; t3 with no prominent setae. Body color usually bluish; though the thorax is sometimes green and the abdomen is usually blue to blue-purple. Presutural area of the thorax mostly microtomentose, posterolateral areas polished; anterior abdominal tergites with tomentum, T4 and T5 polished. Male genitalia in lateral view with surstylus narrow at base, expanding broadly posteriorly in lower half; cercus tapering to a point from a broad base, much longer than surstylus. In posterior view, surstylus curved sharply inward, cercus short (Figs. 48, 49). Phallus and other male characters and ovipositor are typical of the *L. eximia* group (Figs. 60–61, 76–78, 86, 93).



FIGURES 62–72. 62, 63. Phallus of *Lucilia rica* in left lateral and dorsal views. 64–72. Ejaculatory sclerites, pre- and postgonites and hypandria of *Lucilia*. 64–66. *L. cluvia*. 67–69. *L. eximia*. 70, 71, 72. *L. fayeae*.

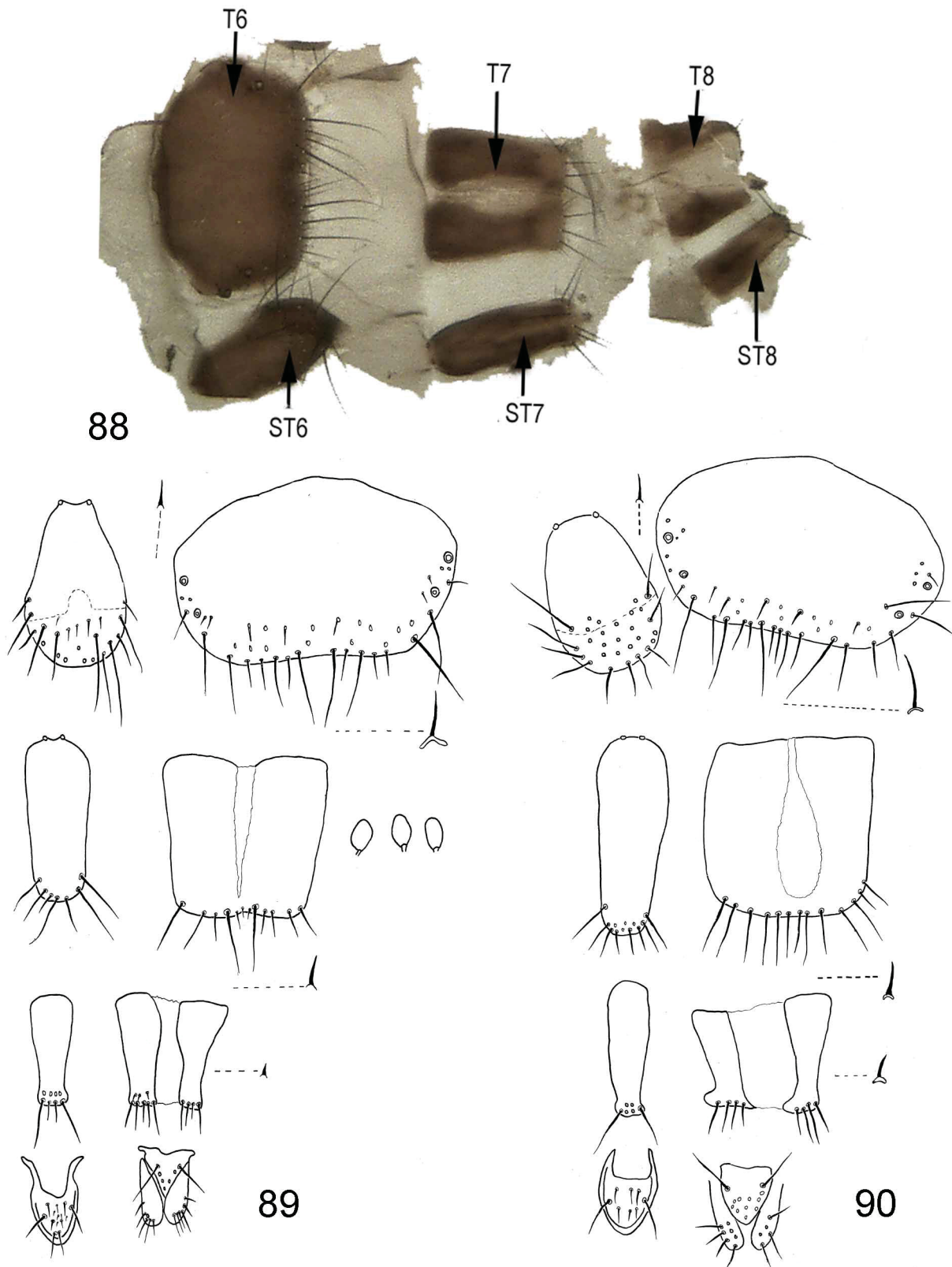


FIGURES 73–87. 73–81. Ejaculatory sclerites, pre- and postgonites, and hyandria of *Lucilia*. 73–75. *L. lucigerens*. 76–78. *L. retroversa*. 79–81. *L. rica*. 82–87. Abdominal sternites of *Lucilia*. 82. *L. chuvia*. 83. *L. eximia*. 84. *L. fayeae*. 85. *L. lucigerens*. 86. *L. retroversa*. 87. *L. rica*.

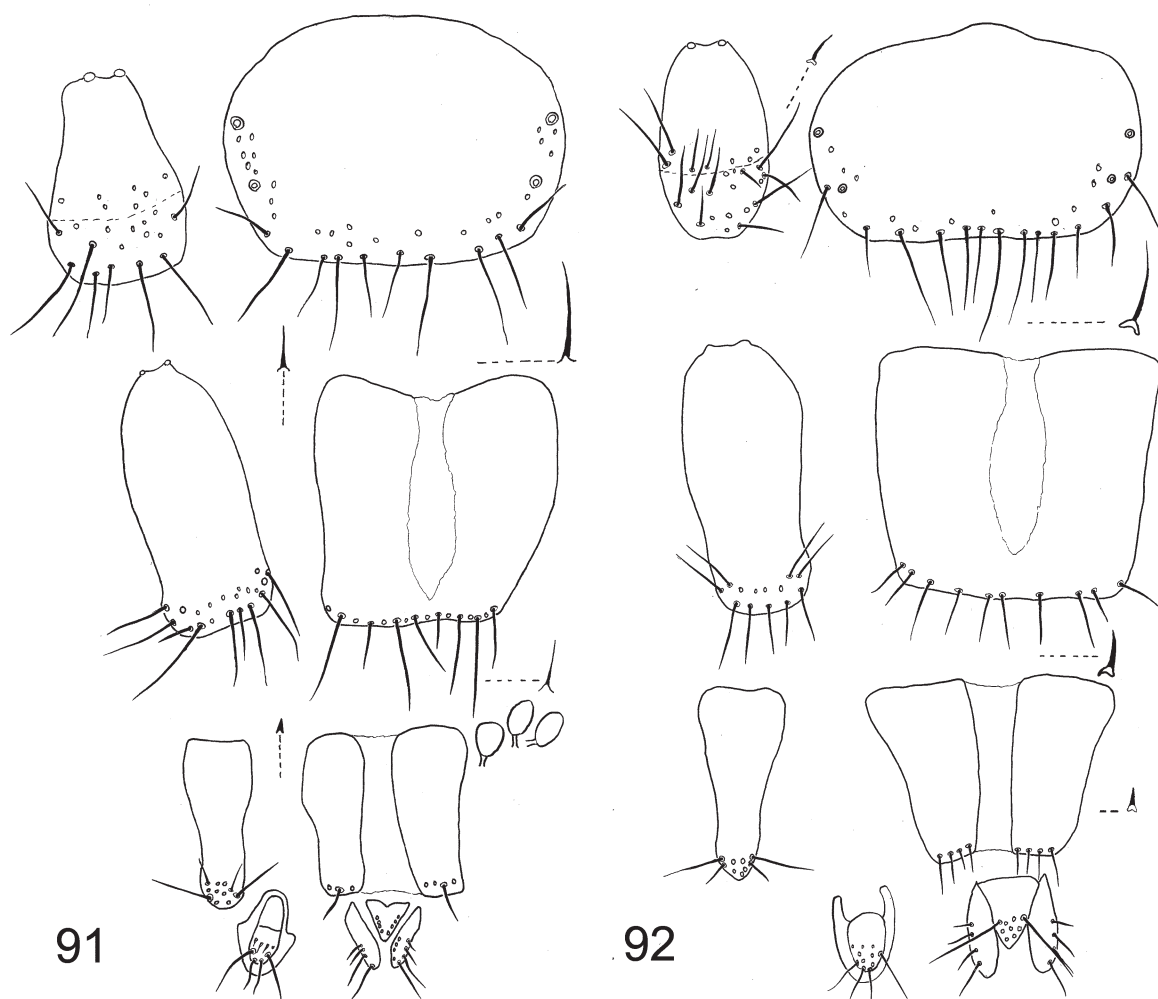
Distribution. Specimens were examined from several Bahamas islands, including Grand (USNM, WSUP), New Providence (WSUP), and San Salvador (USNM). Other locations include Cayman Islands (UCD), Cuba (BMNH, USNM), Dominican Republic (CMNH, USNM) and Haiti (USNM). A single specimen of this species was examined from Mayaguez, Puerto Rico (USNM). It was reared from spoiled meat and collected by H.L. Dozier, Jan. 27, 1936. I examined numerous specimens from Puerto Rico and never found this species again. James (1972) listed this species from Bahamas and Cuba.

Discussion. A long series of specimens from the Dominican Republic is very close to *L. retroversa*. The most obvious difference is the postocular area is yellow to gold and the lappets of the anterior spiracle are orange compared to Bahamian specimens, which have a silvery postocular area and a brown spiracle. After

extensive comparison of morphology, including examination of male and female genitalia, it was concluded the differences are not sufficient to describe these specimens as a separate species.



FIGURES 88–90. Ovipositors of *Lucilia*. 88. *L. retroversa*, tergites and sternites labeled. 89. *L. cluvia*. 90. *L. eximia*.



FIGURES 91–92. Ovipositors of *Lucilia*. 91. *L. fayeae*. 92. *L. lucigerens*.

***Lucilia rica* Shannon**

Figs. 36, 50–51, 62–63, 79–81, 87, 94

Lucilia rica Shannon, 1926: 132

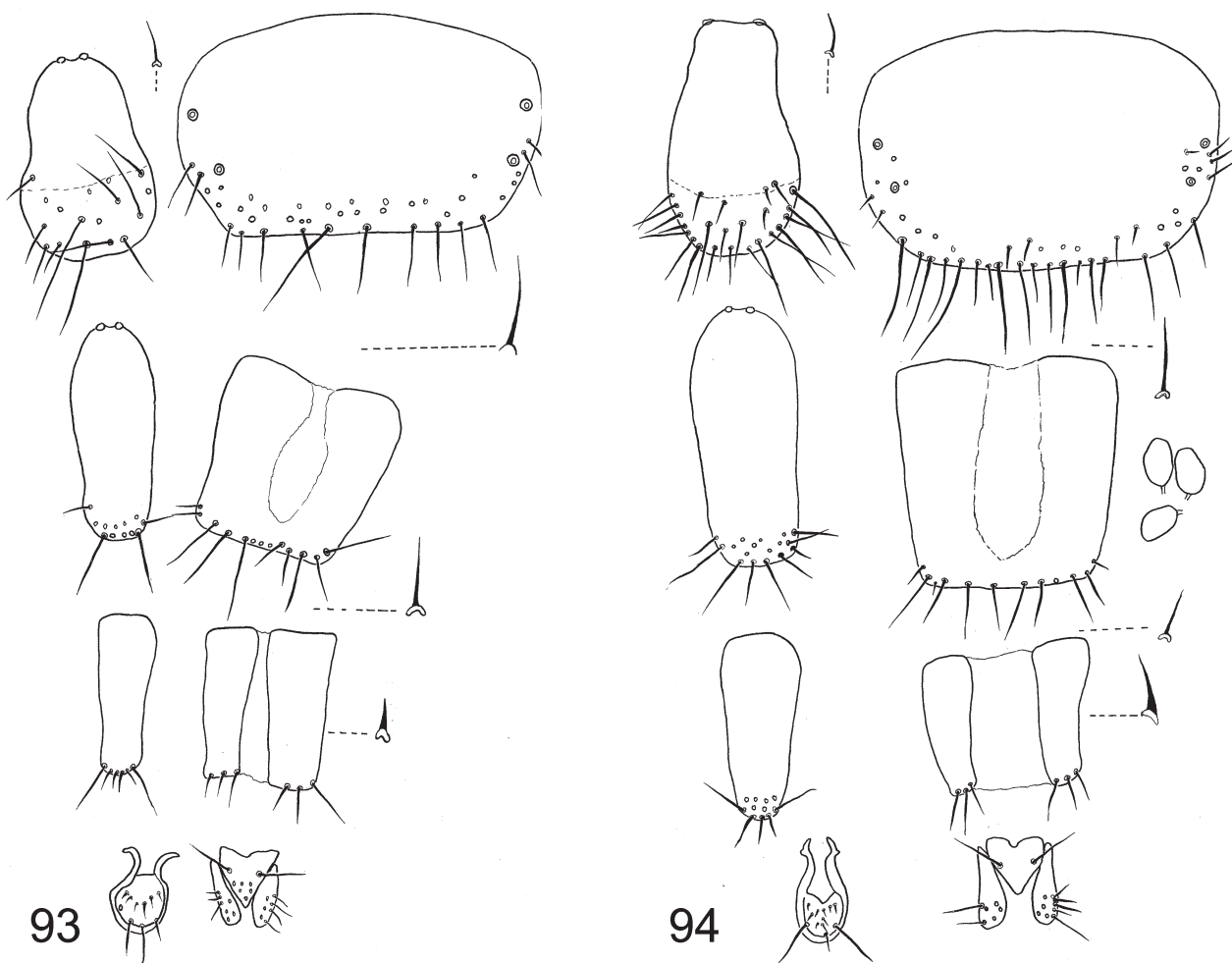
Phaenicia rica: Hall, 1948: 257

Lucilia rica: Woodley and Hilburn, 1994: 13

Diagnosis. Male frons 0.026 (0.02–0.035)/14 of head width, female frons 0.25 (0.24–0.26)/5. Basicosta usually tan, sometimes yellowish to orange; male upper calypter pale, lower tan, both calypters pale in female. Lower genal dilation with pale setae. Tarsi with the following pattern, t1 1p; t2 1a, 1v, 2p; t3 no strong setae. Presutural area of thorax with microtomentum except polished in posterolateral corners; anterior abdominal tergites with microtomentum, rear edge of T3, T4 and T5 polished.

Male genitalia in lateral view with surstylus parallel-sided, straight and digitate, broadly rounded distally; cercus tapering from a broad base to a point, longer than surstylus. In posterior view, lower one-third of surstylus curved inward; cercus long and straight (Figs. 50–51). Phallus, ovipositor and other characters as described for *L. eximia* group (Figs. 62–63, 79–81, 87, 94).

Distribution. Specimens were examined from Antigua (TW, USNM), Bermuda (USNM), Guadeloupe (CNC), and St. Lucia (CNC, FSCA, UGG). James (1970) listed this species from Antigua, Puerto Rico, and possibly Haiti.



FIGURES 93–94. Ovipositors of *Lucilia*. 93. *L. retroversa*. 94. *L. rica*.



FIGURES 95–96. Left lateral view of female *Lucilia*. 95. *L. fayeae*. 96. *L. problematica*.

Discussion. Both sexes have pale setae on gena, a character shared only by *L. cluvia* in the region. Much wider frons of male *L. cluvia* is distinctive for males, see discussion under that species. Females of this species can be confused with female *L. cluvia* because of the pale setae on lower gena. Pattern of microtomentum on the dorsum of abdomen normally separates females. There is some variation in specimens of *L. rica* from Guadeloupe that have microtomentum in upper, outer corners of T4, darker basicosta of *L. rica* separates these specimens.

There is no evidence of *L. rica* from outside the West Indies and Bermuda. I found this species to be quite common in Antigua from the desert-like shorelines to the subtropical forests in the mountains. Surprisingly, this is the only *Lucilia* known from Antigua. Woodley and Hilburn (1994) also reported this to be the dominant species of *Lucilia* in Bermuda.

***Lucilia sericata* (Meigen)**

Musca sericata Meigen, 1826: 53

Phaenicia sericata: Hall, 1948: 259

Lucilia sericata: Whitworth, 2006: 721

Diagnosis. Male frons 0.13/6 (0.12–0.14) of head width; female frons 0.37/8 (0.35–0.40); basicosta orange; calypters white in both sexes; central occipital area with 2–5 setae below inner vertical seta (Whitworth 2006, fig. 73).

Distribution. This species is quite common in the Nearctic Region. Woodley and Hilburn (1994) found it in Bermuda (USNM), though it was not found in the West Indies proper. It was found in nearby Mexico and Costa Rica. It is very close to *L. cuprina*; see Whitworth (2006) for further discussion of characters.

Subfamily Polleniinae

Genus *Pollenia* Robineau-Desvoidy

This genus is widespread in North America.

***Pollenia pediculata* Macquart**

Pollenia pediculata Macquart, 1834: 155

Pollenia pediculata: Whitworth, 2006: 723

One specimen of this species was seen from Bahamas, Eleuthera Island, Rainbow Bay (FSCA). The presence of *P. pediculata* in Bahamas is almost certainly the result of an introduction. See key to the Nearctic species of *Pollenia* in Whitworth (2006) to identify specimens encountered. See note under *Phormia regina*.

Subfamily Melanomyinae

Keys to New World species of this subfamily are given by Downes (1986).

Genus *Angioneura* Brauer and Bergenstamm

This genus has not been recorded from the West Indies. This genus and *Opsodexia* have been included because they may occur there.

Genus *Opsodexia* Townsend

Not currently known from the region.

Genus *Glutoxys* Aldrich

Glutoxys elegans Aldrich

Glutoxys elegans Aldrich, 1929: 2

Glutoxys elegans: Downes, 1986: 4

Diagnosis. Middle of proepisternal depression bare; dull body color; gena 0.25 eye height; posterior surface of head with some whitish setae; dorsal surface of scutellum setose.

Downes (1986) listed it from Santo Domingo, though he was unsure whether the label was referring to Cuba or the Dominican Republic. Two specimens that appear to belong to this species were collected from the Dominican Republic, San Juan Province, July 11, 2006, by N.E. Woodley (USNM).

Genus *Pseudopsodexia* Townsend

A specimen of this genus was examined from the Dominican Republic, Elias Pina Province, July 7, 2006, collected by N.E. Woodley (USNM). Downes (1986) provided a key to two species of this genus, but when an attempt was made to identify this specimen using the key, characters appeared intermediate, suggesting the possibility of an undescribed species. Downes (1986) listed a specimen of *Pseudopsodexia*, *P. horebana* Dodge from Portland, Jamaica in WSUP, but a search for that specimen was unsuccessful. He also listed *P. cruciata* (Reinhard) from Havana, Cuba.

Subfamily Rhiniinae

Genus *Stomorphina* Rondani

Stomorphina lunata (Fabricius)

Musca lunata: Fabricius, 1805, 292

Stomorphina lunata: Hall, 1948: 91

Diagnosis. Venter of costa with setae to just beyond humeral crossvein; subcostal sclerite bare; arista bare lower side; gena with dense, long white setae.

Comments. This is the only Rhiniinae known in the New World, where it is found only in Bermuda. Woodley and Hilburn (1994) reported it was abundant there (USNM).

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Literature cited

- Aldrich, J.M. (1929) New genera and species of muscoid flies. *Proceedings of the United States National Museum*, 76 (Art. 15) [= No. 2812], 1–13.
- Aubertin, D. (1933) Revision of the genus *Lucilia* R.-D. (Diptera: Calliphoridae). *Journal of the Linnean Society of London. Zoology*, 38, 389–436.
- Brauer, F. (1895) Bemerkungen zu einigen neun Gattungen der Muscarien und Deutung einiger Original-Exemplare. *Sitzungsberichte der Akademie der Wissenschaften. Mathematisch-Naturwissenschaftliche Classe*, 104, 582–604.
- Brauer, F. & Bergenstamm, J.E. von (1893) *Die Zweiflügler des Kaiserlichen Museums zu Wien*. VI. Vorarbeiten zu einer Monographie der Muscaria schizometopa (exklusive Anthomyidae). Pars III. F. Tempsky, Wien. 152 pp.
- Coquerel, C. (1858) Note sur les larves appartenant à une espèce nouvelle de diptère (*Lucilia hominivorax*) développées dans les sinus frontaux de l'homme à Cayenne. *Annales de la Société Entomologique de France*, Sér. 3, 6, 171–176.
- Dear, J.P. (1985) A revision of the New World Chrysomyini (Diptera: Calliphoridae). *Revista Brasileira de Zoologia*, 3, 109–169.
- Del Ponte, E. (1938) Las species argentinas de genero *Cochliomyia* T.T. (Diptera Musc.). *Revista de Entomologia, Rio de Janeiro*, 8, 273–281.
- Downes, W.L., Jr. (1986) The Nearctic *Melanomya* and relatives (Diptera, Calliphoridae), a problem in calyptrate classification. *New York State Museum Bulletin*, 460, 35 pp.
- Fabricius, J.C. (1775) *Systema entomologiae, sistens insectorum classes, ordines, genera, species, adiectis synonymis, locis, descriptionibus, observationibus*. Kortii, Flensbvirgi et Lipsiae [= Flensburg and Leipzig]. [30] + 832 pp.
- Fabricius, J.C. (1794) *Entomologia systematica emendata et aucta. Secundum classes, ordines, genera, species adiectis synonymis, locis, observationibus, descriptionibus*. Tom. IV. C.G. Proft, Fil. et Soc., Hafniae [= Copenhagen]. [6] + 472 + [5] pp.
- Fabricius, J.C. (1805) *Systema antliatorum secundum ordines, genera, species adiectis synonymis, locis, observationibus, descriptionibus*. C. Reichard, Brunsvigae [= Brunswick]. xiv + 15–372 + [1 (Errata)] + 30 pp.
- Hall, D.J. (1948) *The blowflies of North America*. Thomas Say Foundation. Lafayette, Indiana. 477 pp.
- James, M.T. (1967) The blow flies of Dominica. *Proceedings of the Entomological Society of Washington*, 69, 368.
- James, M.T. (1970) A catalogue of the Diptera of the Americas south of the United States: family Calliphoridae. *Museu de Zoologica, Universidade de Sao Paulo*, 102, 1–28.
- James, M.T. (1971) Two new species of *Phaenicia* from the West Indies (Diptera: Calliphoridae). *Proceedings of the Entomological Society of Washington*, 73, 38–385.
- Johnson, C.W. (1913) The dipteran fauna of Bermuda. *Annals of the Entomological Society of America*, 6, 443–452.
- Macquart, J. (1834) *Insectes diptères du nord de la France. Athéricères: créophiles, oestrides, myopaires, conopsaires, scénopiniens, céphalopsides*. [Vol. 5.] L. Danel, Lille. 232 pp. + 6 pls.
- Macquart, J. (1844) *Diptères exotiques nouveaux ou peu connus*. Tome deuxième. 3.e partie [1843]. Roret, Paris. 304 pp. + 36 pls.
- Macquart, J. (1855) *Diptères exotiques nouveaux ou peu connus*. 5.e supplément. *Mémoires de la Société Royale des Sciences, et l'Agriculture et des Arts de Lille*, Sér. 2, 1, 25–156 + 7 pls.
- Meigen, J.W. (1826) *Systematische Beschreibung der bekannten europäischen zweiflügeligen Insekten*. Fünfter Theil. Schulz, Hamm. xii + 412 pp. + pls. 42–54.
- Mariluis, J.C., Gonzalez-Mora, D. & Peris, S.V. (1994) Notes on the *Phaenicia* Robineau-Desvoidy, 1863 of South America (Diptera, Calliphoridae). *Boletín de la Real Sociedad Española de Historia Natural, Sección Biológica*, 91, 25–33.
- McAlpine, J.F. (1981) Morphology and terminology—adults. In: McAlpine, J.F., Peterson, B.V., Shewell, G.E., Teskey, H.J., Vockeroth, J.R. & Wood, D.M. (eds.), *Manual of Nearctic Diptera*. Volume 1. *Agriculture Canada Monograph*, 27, 9–63.
- Peris, S.V., Gonzalez-Mora, D., Fernandez, A.M. & Peris, S.J. (1998) A new species of *Calliphora* Robineau-Desvoidy, 1830 (Diptera: Calliphoridae) from Sierra Maestra, Cuba. *Boletín de la Real Sociedad Española de Historia Natural, Sección Biológica*, 94, 49–52.
- Robineau-Desvoidy, J.B. (1830) Essai sur les myodaires. *Mémoires présentés par divers Savans à l'Académie Royale des*

- Rognes, K. (1991) Blowflies (Diptera, Calliphoridae) of Fennoscandia and Denmark. *Fauna Entomologica Scandinavica*, 24, 272 pp.
- Rognes, K. (2009) Revision of the Oriental species of the *Bengalia peuhi* species-group (Diptera, Calliphoridae). *Zootaxa*, 2251, 1–76.
- Rognes, K. & Paterson, H.E.H. (2005) *Chrysomya chloropyga* (Wiedemann, 1818) and *C. putoria* (Wiedemann, 1830) (Diptera: Calliphoridae) are two different species. *African Entomology*, 13, 49–70.
- Sabrosky, C.W., Bennett, G.F. & Whitworth, T.L. (1989) *Bird blowflies (Protocalliphora) in North America (Diptera: Calliphoridae) with notes on Palearctic species*. Smithsonian Institution Press, Washington. 312 pp.
- Shannon, R.C. (1926) Synopsis of the American Calliphoridae (Diptera). *Proceedings of the Entomological Society of Washington*, 28, 115–139.
- Townsend, C.H.T. (1915) Proposal of new muscoid genera for old species. *Proceedings of the Biological Society of Washington*, 28, 19–23.
- Vargus, J. & Wood, D.M. (2010) Calliphoridae. In: Brown, B.V., Borkent, A., Cumming, J.M., Wood, D.M., Woodley, N.E. & Zumbado, M. (eds.), *Manual of Central American Diptera*. Volume 2. *National Research Council Press*, Ottawa, Canada. In Press.
- Walker, F. (1849) *List of the specimens of dipterous insects in the collection of the British Museum*. Part IV. London. Pp. 689–1172.
- Wells, J.D. & Sperling, F.A.H. (1999) Molecular phylogeny of *Chrysomya albiceps* and *C. rufifacies* (Diptera: Calliphoridae). *Journal of Medical Entomology*, 36, 222–226.
- Whitworth, T.L. (2006) Keys to the genera and species of blow flies (Diptera: Calliphoridae) of America north of Mexico. *Proceedings of the Entomological Society of Washington*, 108, 689–725.
- Wiedemann, C.R.W. (1818) Neue Insecten vom Vorgebirge der guten Hoffnung. *Zoologisches Magazin*, 1 (2), 40–48.
- Wiedemann, C.R.W. (1819) Beschreibung neuer Zweiflügler aus Ostindien und Afrika. *Zoologisches Magazin*, 1 (3), 1–39.
- Wiedemann, C.R.W. (1830) *Aussereuropäische zweiflügelige Insekten*. Als Fortsetzung des Meigenschen Werkes. Zweiter Theil. Schulz, Hamm. xii + 684 pp. + 5 pls.
- Woodley, N.E. & Hilburn, D.J. (1994) The Diptera of Bermuda. *Contributions of the American Entomological Institute*, 28, 1–64.
- Wulp, F.M. van der (1896) Aanteekeningen betreffende Oost-Indische Diptera. *Tijdschrift voor Entomologie*, 39, 95–113.
- Zumt, F. (1956) Calliphoridae (Diptera, Cyclorrhapha). Part 1: Calliphorinae and Chrysomyini. *Exploration du Parc National Albert, Mission G.F. de Witte (1933–1935)*, 87, 200 pp.
- Zumt, F. (1965) *Myiasis in man and animals of the Old World. A textbook for physicians, veterinarians and zoologists*. Butterworths, London. 267 pp.